ADVANCED AND EVER ADVANCING MITSUBISHI ELECTRIC

MITSUBISHI
VARIABLE FREQUENCY DRIVES

ACP&D Limited

A500 SERIES

ADVANCED INTELLIGENT CONTROL

The Culmination of Mitsubishi's Expertise Reaches into the Realms of Advanced Technology Expanding the Potential of Inverters

Announcing the FR-A500 Series, a new line of advanced inverters that combines Mitsubishi Electric's original technology with the benefits of its vast pool of accumulated expertise. Beginning with advanced magnetic flux vector control, which allows high-precision operations at ultra-low speeds, Mitsubishi has mastered many aspects of advanced technology to equip this series with performance of the highest order. With their astonishing top-level specifications, this new series opens up an entirely new area of potential for inverters in the 21st Century.

EN 29001/ISO 9001/BS 5750 APPROVED BY BVQI

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CONTENTS

Features

1. The Ability to Maximize Drive Performance

Advanced Flux Vector Control

New levels in drive performance have been achieved thanks to the use of advanced flux vector control, an original technology developed by Mitsubishi.

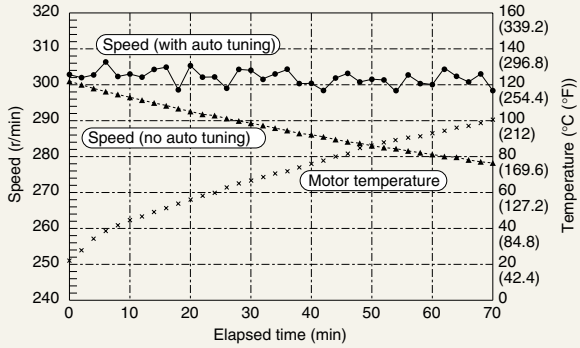
● High-precision Operations without a PLG

The units feature a RISC processor which is used for on-line auto tuning, turning the motor quickly when starting. This allows it to perform high-precision operations that are unaffected by motor temperature, as well as stable high-torque operation from ultra low speeds.
Speed control range: 1:120 (0.5~60Hz, driving mode)
Using the auto tuning function, high precision operation is possible with motors from all over the world.

● Boost Performance even further with PLG feedback

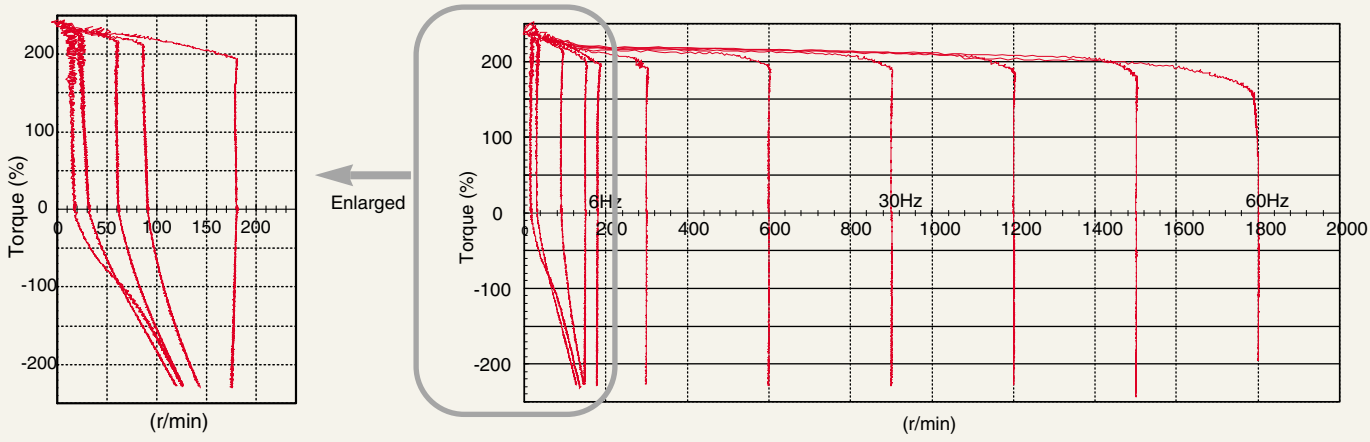
Combining this function with a motor equipped with PLG feedback improves high-precision operations still further (built-in option FR-A5AP).
* Use an inverter that is one rank higher than the motor capacity.
Speed control range: 1:1000 (driving mode)
Speed variation rate: ±0.02% (driving mode)
Zero speed holding torque: 150% (short time rating)

Example of motor temperature/speed variation characteristics (SFJR 4P 3.7kW motor). (Repeated operations at 90% usage rate, on-line auto tuning selected)



Example of speed/torque characteristics during low-speed operations (SF-JR 4P 3.7kW motor)

Example of speed/torque characteristics when using advanced flux vector control (on-line tuning selected, SF-JR 4P 3.7kW motor)

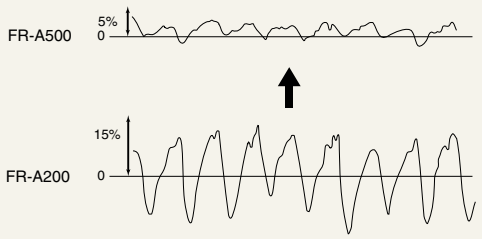


Smart Driver

Uneven rotation at low speeds has been greatly improved by the use of a smart driver (a newly developed ASIC) which directly monitors and controls the main circuit's status.

- Uneven rotation: less than half that of a conventional Mitsubishi inverter at 1 Hz

Example of comparative data on uneven rotation
(inverter operation frequency: 3Hz; SF-JR 4P 3.7kW motor)



High-response Current Limit

Further improving the responsiveness of current detection has reduced the occurrence of trips arising from overcurrent.

This makes it possible to deal more effectively with the momentary large currents that occur when starting a reverse coasting motor or when switching an MC ON and OFF on the inverter output.

New Functions

The addition of a number of new functions has made it possible to handle various applications.

Some examples are:

- Power failure deceleration stop function
  → Rotary cutters, etc.
- PID control → Air-conditioning, etc.
- Brake sequence function → Conveyors, etc.
- Commercial power supply inverter switch-over sequence function → Pumps, etc.

Expandability

Various I/Os are available, including pulse train, analog signals, digital signals, and network connections.

- Up to three option cards can be mounted internally.
- Direct communications with a PLC is possible, e.g. Control & Communication Link (CC-Link).
  Accommodates PLC X/Y instructions for easy programming.

Features

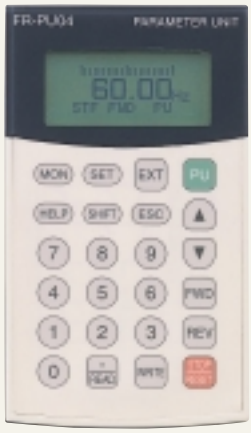
2. Achieves New Levels of User-friendliness

Simple Operation

- The simple FR-DU04 control panel is provided as standard on all models.
  An optional extension cable can be used with the control panel. Operational and alarm signals can also be shown with this unit.
- The FR-PU04 LCD parameter unit with long-life backlight display is available as an option.
  The unit features Mitsubishi's original direct input method which uses the ten-key pad. Eight different languages are available on one unit.
- The parameter user group function is provided as standard.
  This function facilitates control of parameters by making it possible to select, read and write only those parameters that are required.
- Communications is a standard feature.
  The control panel can be disconnected to allow the unit to be controlled by a personal computer via an RS-485 interface.
  Note: A converter is necessary if an RS-232C interface is to be used.

FR-DU04 control panel

FR-PU04 parameter unit (option)



Easy Maintenance

- The life of the cooling fan has been extended by the use of ON/OFF control, and replacement is easier.

Simple to install/remove control terminals

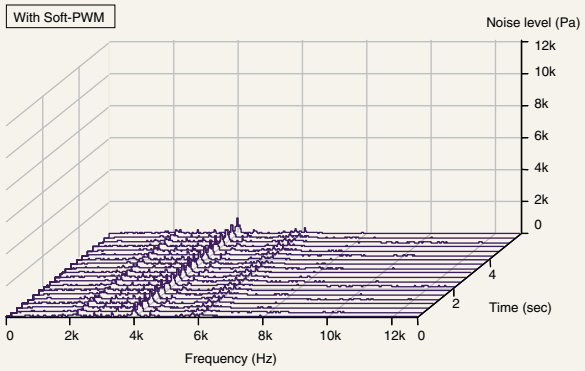
- Simple installation and removal of the control terminal block makes maintenance easier.
- Parameters can be preserved by the control panel which is fitted as standard.
  When an inverter is replaced, parameters can be set up simply by writing previously stored parameters from the control panel.
  Note: It is necessary to batch-read the parameters at the control panel beforehand.

3. Environmentally Friendly

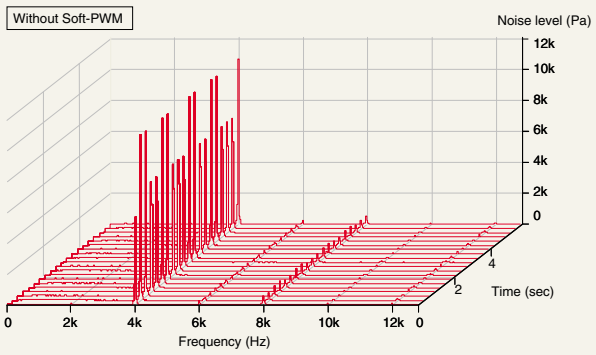
Soft-PWM Control

In addition to the conventional low-noise mode, Mitsubishi has developed its own original Soft-PWM control method which suppresses the increase in acoustic noise and limits RFI noise to minimum levels similar to those of the Mitsubishi FR-Z Series inverter.
Note: The default setting is Soft-PWM control ON.

Motor Noise Data Example (SF-JR 4P 3.7kW motor, carrier frequency 2kHz)



Since the frequency components are dispersed, the motor generates little metallic noise and does not sound unpleasant.



Since the frequency components are concentrated, the motor generates a grating metallic noise.

Compatible with Harmonic Limits

- A compact direct current reactor (DCR) can be connected to units of all capacities.
- It is also possible to connect a high-power factor regenerative converter (FR-HC) that conforms to Japanese harmonic guidelines (conversion coefficient: K5=0).

EMC Filter Available

- Using the optional EMC filter makes it easy to comply with European EMC Directives.

4. World-standard Specifications

Compliance with Major International Standards

- All units comply with UL, CSA* and EN standards (low-voltage directives) as standard.
  *In order to obtain CSA standards approval at UL, the cUL mark is applied.
- NEMA1 compliance is standard up to 22K.
- The optional FR-PUO4 parameter unit can handle eight languages: Japanese, English, German, French, Spanish, Italian, Swedish and Finnish

Compliance with Main International Communications Standards

- North America - DeviceNet™ Modbus plus
- Europe - Profibus DP

Compliance with 240V power supplies (maximum 22K) and 480V power supplies as standard

Sink/Source Logic is selectable

(Using jumper on terminal block).

Model Configuration

Model

FR - A520 - 3.7K

Type	Voltage class
A520	200V class
A540	400V class

Type	Applicable Motor Capacity
0.4K-280K	Indicates capacity in kW

Model Configuration

Applicable Motor Capacity (kW)	Power Supply Voltage	
	200V class	400V class
0.4	FR-A520-0.4K	FR-A540-0.4K
0.75	FR-A520-0.75K	FR-A540-0.75K
1.5	FR-A520-1.5K	FR-A540-1.5K
2.2	FR-A520-2.2K	FR-A540-2.2K
3.7	FR-A520-3.7K	FR-A540-3.7K
5.5	FR-A520-5.5K	FR-A540-5.5K
7.5	FR-A520-7.5K	FR-A540-7.5K
11	FR-A520-11K	FR-A540-11K
15	FR-A520-15K	FR-A540-15K
18.5	FR-A520-18.5K	FR-A540-18.5K
22	FR-A520-22K	FR-A540-22K
30	FR-A520-30K	FR-A540-30K
37	FR-A520-37K	FR-A540-37K
45	FR-A520-45K	FR-A540-45K
55	FR-A520-55K	FR-A540-55K
75	Available soon	Available soon
90	Available soon	–
110	–	Available soon
160	–	Available soon
220	–	Available soon
280	–	Available soon

Applicable motors with capacities of 75kW and over are not covered in this catalog.

Standard Specifications

Ratings

200V class

Type FR-A520- ☐☐			0.4K	0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Applicable motor capacity (kW) (Note 1)			0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) (Note 2)		1.1	1.9	3.1	4.2	6.7	9.2	12.6	17.6	23.3	29	34	44	55	67	82
	Rated current (A)		3	5	8	11	17.5	24	33	46	61	76	90	115	145	175	215
	Overload current rating (Note 3)		150% for 60 sec., 200% for 0.5 sec. (Inverse time characteristics)														
	Voltage (Note 4)		3-phase 200 - 220V 50Hz, 200 - 240V 60Hz											3-phase 200 - 220V 50Hz, 200 - 230V 60Hz			
	Regenerative braking torque	Max. value/time	150% for 5 sec.			100% for 5 sec.				20% (Note 5)							
		Tolerable working rate	3%ED					2%ED		Continuous (Note 5)							
Power supply	Rated input, AC voltage, frequency		3-phase 200 - 220V 50Hz, 200 - 240V 60Hz											3-phase 200 - 220V 50Hz, 200 - 230V 60Hz			
	Tolerable AC voltage fluctuation		170 - 242V 50Hz, 170 - 264V 60Hz											170 - 242V 50Hz, 170 - 253V 60Hz			
	Tolerable frequency fluctuation		± 5%														
	Power facility capacity (kVA) (Note 6)		1.5	2.5	4.5	5.5	9	12	17	20	28	34	41	52	66	80	100
Protective structure (JEM1030)			Fully enclosed type (IP20, NEMA1)											Open type (IP00)			
Cooling method			Self cooling		Forced cooling												
Approx. weight (kg (lb))			2.0 (4.4)	2.5 (5.5)	3.5 (7.7)	3.5 (7.7)	3.5 (7.7)	6.0 (13.2)	6.0 (13.2)	8.0 (17.6)	13.0 (28.7)	13.0 (28.7)	13.0 (28.7)	30.0 (66.1)	40.0 (88.2)	40.0 (88.2)	50.0 (110.2)

400V class

Type FR-A540- ☐☐			0.4K	0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Applicable motor capacity (kW) (Note 1)			0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) (Note 2)		1.1	1.9	3	4.2	6.9	9.1	13	17.5	23.6	29	32.8	43.4	54	65	84
	Rated current (A)		1.5	2.5	4	6	9	12	17	23	31	38	43	57	71	86	110
	Overload current rating (Note 3)		150% for 60 sec., 200% for 0.5 sec. (Inverse time characteristics)														
	Voltage (Note 4)		3-phase 380 - 480V 50Hz/ 60Hz														
	Regenerative braking torque	Max. value/time	100% for 5 sec.							20% (Note 5)							
		Tolerable working rate	2%ED							Continuous (Note 5)							
Power supply	Rated input, AC voltage, frequency		3-phase 380 - 480V 50Hz/ 60Hz														
	Tolerable AC voltage fluctuation		323 - 528V 50Hz/ 60Hz														
	Tolerable frequency fluctuation		± 5%														
	Power facility capacity (kVA)		1.5	2.5	4.5	5.5	9	12	17	20	28	34	41	52	66	80	100
Protective structure (JEM1030)			Fully enclosed type (IP20, NEMA1)											Open type (IP00)			
Cooling method			Self cooling			Forced cooling											
Approx. weight (kg (lb))			3.5 (7.7)	3.5 (7.7)	3.5 (7.7)	3.5 (7.7)	3.5 (7.7)	6.0 (13.2)	6.0 (13.2)	13.0 (28.7)	13.0 (28.7)	13.0 (28.7)	13.0 (28.7)	24.0 (53.0)	35.0 (77.3)	35.0 (77.3)	36.0 (79.5)

Notes: 1. "Applicable motor capacity" refers to the maximum applicable capacity when using a 4-pole standard Mitsubishi motor.
2. The rated output capacity is 220V for the 200V class, and 440V for the 400V class.
3. The percentage given for the overload current rating indicates the ratio with respect to the inverter's rated output current. In the case of repeated use, it is essential to wait until the inverter and the motor have cooled to below the temperature for 100% load.
4. The maximum output voltage may not exceed the power supply voltage, and can be set at any value below the power supply voltage.
5. Indicates the average torque for decelerating to a stop from 60Hz. Changes according to motor loss.
6. Power capacity differs according to the power supply impedance value (including the input reactor or wire values).

Standard Specifications

Common Specifications

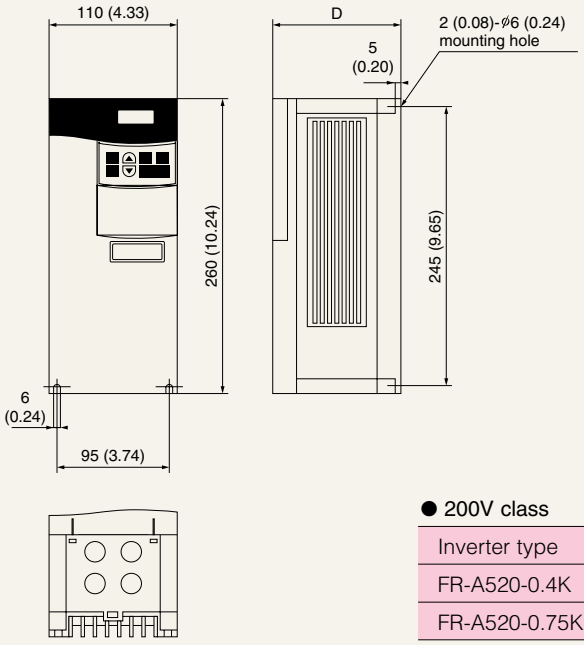
Control Specifications	Control Method		Soft-PWM control, high-carrier frequency PWM control (V/F control, advanced flux vector control selection)
	Output frequency range		0.2 to 400Hz
	Frequency control resolution	Analog input	0.015 Hz (Terminal No. 2 input: 12 bit/0 to 10V, 11 bit/0 to 5V; Terminal No. 1 input: 12 bit/-10 to +10V, 11 bit/-5 to +5V)
		Digital input	0.01Hz
	Frequency precision		Within ±0.2% of max. output frequency (25°C (53°F)±10°C (±21.2°F))/during analog input: within 0.01% of set output frequency during digital input
	Voltage/frequency characteristics		Any base frequency setting possible between 0 and 400 Hz; constant torque or variable torque pattern selection possible.
	Starting torque		150% at 0.5 Hz (advanced flux vector control)
	Torque boost		Manual torque boost
	Acceleration/deceleration time setting		0 to 3,600 sec. (individual setting for acceleration/deceleration possible), linear or S-curve mode
	DC braking		Operation frequency (0 to 120 Hz), operation time (0 to 10 sec.), operation voltage (0 to 30%) variable
	Stall prevention operation level		Operation current level setting possible (0 to 200% variable), enable/disable selection
Operation Specifications	Frequency setting signal	Analog input	DC0 to 5V, 0 to 10V, 0 to ±10V, 4 to 20mA
		Digital input	Input from control panel, parameter unit; BCD 3-digit or 12-digit binary (using option FR-A5AX)
	Starting signal		Individual selection of forward run, reverse run; starting signal self-hold input (3-wire input) selective
	Input signal	Multi-speed selection	Up to 15 set speeds (each speed can be set between 0 and 400 Hz; speed can be changed via control panel or parameter unit during operation)
		2nd, 3rd accel/decel time	0 to 3,600 sec. (max. of three individual accelerations/decelerations can be set)
		JOG operation selection	JOG operation mode selection terminal provided (Note 1)
		Current input selection	Select input of frequency setting signal 4 to 20 mA DC (terminal No. 4)
		Output stop	Instant cutoff of inverter output (frequency, voltage)
		Error reset	Reset of protection operation hold state
	Operation functions		Upper/lower limit frequency setting, frequency jump operation, external thermal input selection, reverse polarity operation, instantaneous power failure restart operation, commercial power supply inverter switch-over function, forward run/reverse run prevention, slip compensation, operation mode selection, off-line auto tuning function, online auto tuning function, PID control, programmed operation, computer link operation (RS-485)
	Out-put signal	Operation status	Five types can be selected from: inverter running, frequency reached, instantaneous power failure (undervoltage), frequency detection, 2nd frequency detection, 3rd frequency detection, in program mode operation, in PU operation, overload warning, regenerative brake pre-alarm, electronic thermal relay pre-alarm, zero current detection, output current detection, PID lower limit, PID upper limit, PID forward run, PID reverse run, commercial power supply-inverter switchover MC 1, 2, 3, operation ready, brake release request, fan trouble, and fin overheat re-alarm. Open collector output.
		Error (inverter trip)	Relay output - contactor (230 VAC 0.3A 30 VDC 0.3A); open collector - alarm code (4-bit) output
		For meter	One type can be selected from: output frequency, motor current (constant or peak value), output voltage, frequency setting value, operation speed, motor torque, converter output voltage (constant or peak value), regenerative brake duty, electronic thermal relay load rate, input power, output power, load meter and motor excitation current. Pulse train output (1,440 pulse/sec./full scale) or analog output (0 to 10 VDC).
Display	Displayed on FR-DU04 control panel or FR-PU04 parameter unit	Operation status	Select from output frequency, motor current (constant or peak value), output voltage, frequency setting value, operation speed, motor torque, overload, converter output voltage (constant or peak value), electronic thermal relay load rate, input power, output power, load meter, motor excitation current, cumulative power ON time, actual operation time, cumulative power, regenerative brake duty and motor load rate.
		Error details	Details of errors are displayed when the protective function activates. Details of up to eight errors are saved. (Only four errors are displayed on the control panel.)
	Additional displays only on FR-PU04 parameter unit	Operation status	Input terminal signal status, output terminal signal status, option mounting status, terminal assignment status.
		Error details	Output voltage, current, frequency and cumulative power ON time before protective function activates
		Interactive	Operation guide and troubleshooting with help function
Protective and warning functions			Overcurrent cutoff (during acceleration, deceleration, constant speed), regenerative overvoltage cutoff, undervoltage, instantaneous power failure, overload cutoff (electronic thermal relay), brake transistor error (Note 2), ground fault overcurrent, output short circuit, stall prevention, overload warning, brake resistor overheating, fin overheating, fan trouble, option error, parameter error, PU disconnected number of retries exceeded, output phase loss, CPU error, 24VDC power output short circuit, control panel power short circuit.
Environment	Ambient temperature		-l0°C (-21.2°F) to +50°C (+106°F) (no freezing) (-10°C (-21.2°F) to +40°C (+84.8°F) using fully enclosed structure specifications attachment (FR-A5CV))
	Ambient humidity		90%RH or less (no condensation)
	Storage temperature (Note 3)		-20°C (+42.4°F) to +65°C (+137.8°F)
	Atmosphere		Indoors (no corrosive gases, flammable gases, oil mist or dust)
	Altitude and vibration		Max. 1,000 m (3,280.8 ft) above sea level, max. 5.8 m (19.03 ft)/s² {0.6G} (JIS C 0911 compliance)

Notes:
1. JOG operation is possible with the control panel and parameter unit.
2. Not provided for models FR-A520-11 K through 55K, or models FR-A540-11 K through 55K, which have no brake circuits.
3. Temperatures to which the units can be exposed for a short time, such as during transportation.

External Dimension Diagrams

FR-A520-0.4K, 0.75K

units: mm (inch)

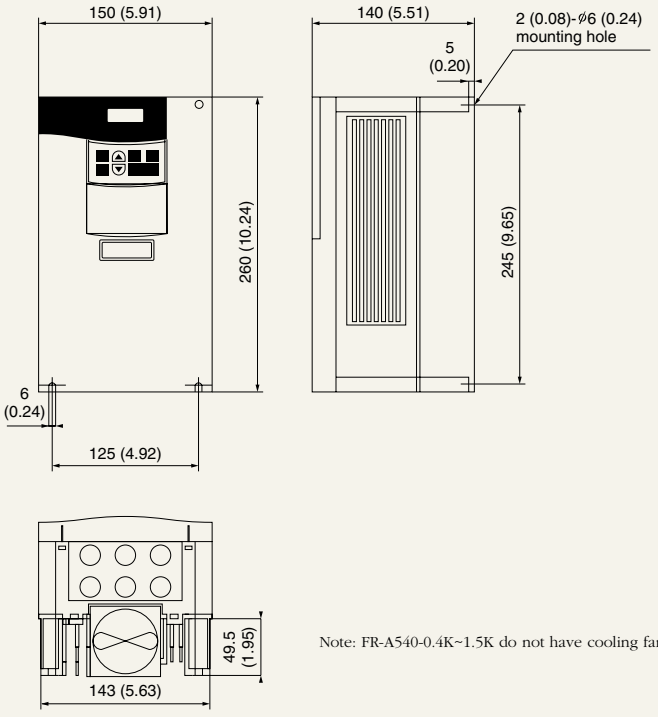


● 200V class

Inverter type	D
FR-A520-0.4K	110 (4.33)
FR-A520-0.75K	125 (4.92)

FR-A520-1.5K, 2.2K, 3.7K
FR-A540-0.4K, 0.75K, 1.5K, 2.2K, 3.7K

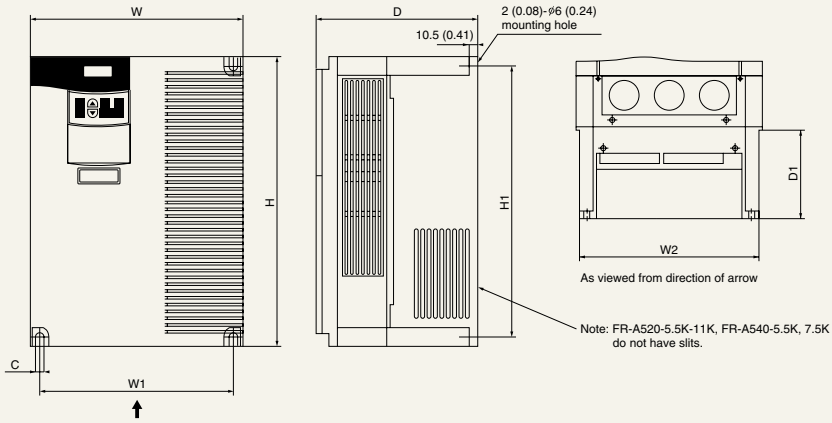
units: mm (inch)



Note: FR-A540-0.4K~1.5K do not have cooling fans.

External Dimension Diagrams

FR-A520-5.5K, 7.5K, 11K, 15K, 18.5K, 22K
FR-A540-5.5K, 7.5K, 11K, 15K, 18.5K, 22K



units: mm (inch)

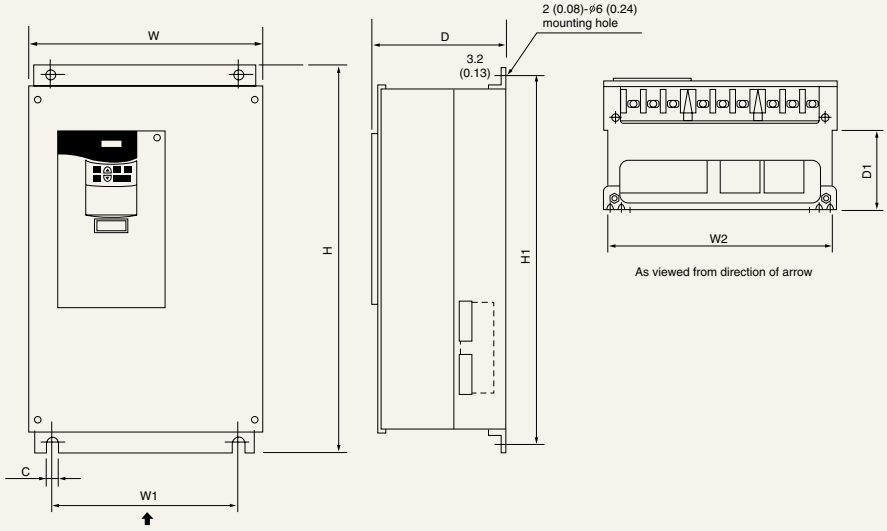
● 200V class

Inverter type	W	W1	W2	H	H1	D	D1	C
FR-A520-5.5K/7.5K	220 (8.66)	195 (7.68)	211 (8.31)	260 (10.24)	245 (9.65)	170 (6.69)	86.5 (3.41)	6 (0.24)
FR-A520-11K	220 (8.66)	195 (7.68)	211 (8.31)	300 (11.81)	285 (11.22)	190 (7.48)	101.5 (4.00)	6 (0.24)
FR-A520-15K/18.5K/22K	250 (9.84)	230 (9.06)	242 (9.53)	400 (15.75)	380 (14.96)	190 (7.48)	101.5 (4.00)	10 (0.39)

● 400V class

Inverter type	W	W1	W2	H	H1	D	D1	C
FR-A540-5.5K/7.5K	220 (8.66)	195 (7.68)	211 (8.31)	260 (10.24)	245 (9.65)	170 (6.69)	86.5 (3.41)	6 (0.24)
FR-A540-11K/15K/18.5K/22K	250 (9.84)	230 (9.06)	242 (9.53)	400 (15.75)	380 (14.96)	190 (7.48)	101.5 (4.00)	10 (0.39)

FR-A520-30K, 37K, 45K, 55K
FR-A540-30K, 37K, 45K, 55K



units: mm (inch)

● 200V class

Inverter type	W	W1	W2	H	H1	D	D1	C
FR-A520-30K	340 (13.39)	270 (10.63)	320 (12.60)	550 (21.65)	530 (20.87)	195 (7.68)	71.5 (2.81)	10 (0.39)
FR-A520-37K/45K	450 (17.72)	380 (14.96)	430 (16.93)	550 (21.65)	525 (20.67)	250 (9.84)	154 (6.06)	12 (0.47)
FR-A520-55K	480 (18.90)	410 (16.14)	460 (18.11)	700 (27.56)	675 (26.57)	250 (9.84)	154 (6.06)	12 (0.47)

● 400V class

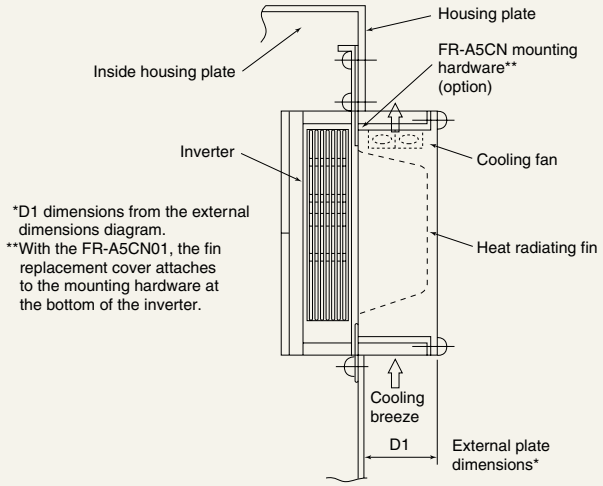
Inverter type	W	W1	W2	H	H1	D	D1	C
FR-A540-30K	340 (13.39)	270 (10.63)	320 (12.60)	550 (21.65)	530 (20.87)	195 (7.68)	71.5 (2.81)	10 (0.39)
FR-A540-37K/45K/55K	450 (17.72)	380 (14.96)	430 (16.93)	550 (21.65)	525 (20.67)	250 (9.84)	154 (6.06)	12 (0.47)

Making the housing plate more compact

When the inverter is being used inside a housing plate, the heat generated inside the plate can be greatly reduced by projecting the inverter's heat radiating fin outside of the plate. This mounting method is recommended when trying to reduce the size of a completely sealed housing plate.

Notes
1. When mounting, use mounting attachment FR-A5CN (sold separately) (for models 1.5K~55K).
2. The fin height is greater than the height of the FR-A200 series.

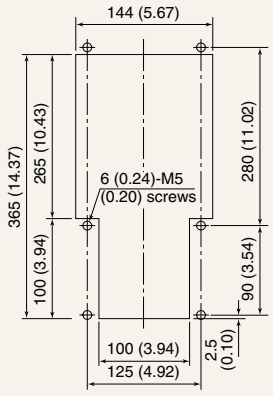
Model	Compatible inverter	
	200V class	400V class
FR-A5CN01	FR-A520-1.5~3.7K	FR-A540-0.4K~3.7K
FR-A5CN02	FR-A520-5.5K/7.5K	FR-A540-5.5K/7.5K
FR-A5CN03	FR-A520-11K	—
FR-A5CN04	FR-A520-15K~22K	FR-A540-11K~22K



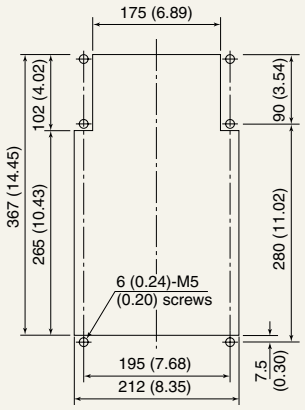
*D1 dimensions from the external dimensions diagram.
**With the FR-A5CN01, the fin replacement cover attaches to the mounting hardware at the bottom of the inverter.

Panel cut dimensions (when using FR-A5CN)

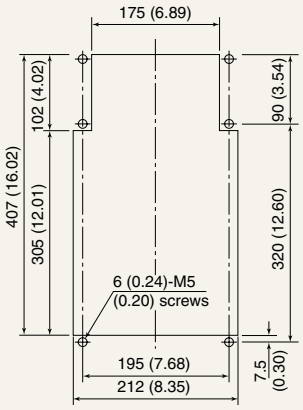
●FR-A5CN01



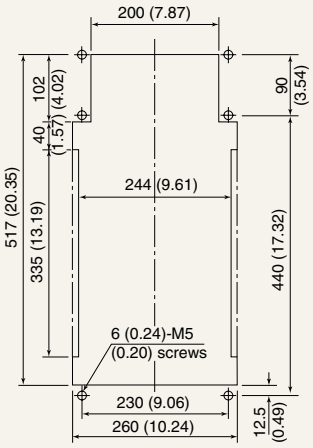
●FR-A5CN02



●FR-A5CN03

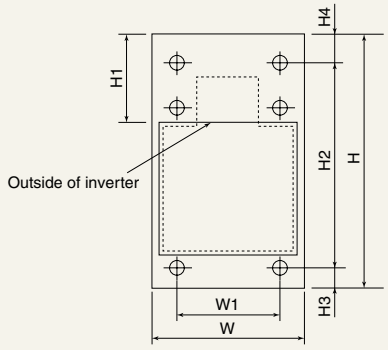


●FR-A5CN04



units: mm (inch)

Dimensions after mounting of attachment (when using FR-A5CN)

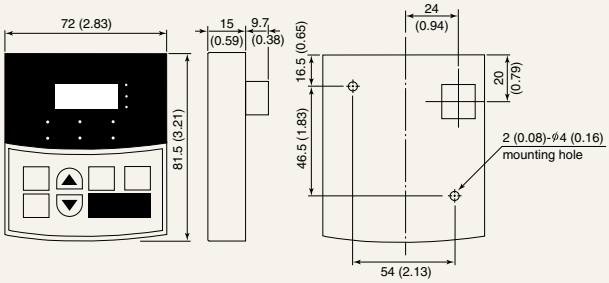


units: mm (inch)

Model	W	H	H1	W1	H2	H3	H4
FR-A5CN01	150 (5.91)	389.5 (15.33)	18 (0.71)	125 (4.92)	370 (14.57)	11.5 (0.45)	8 (0.31)
FR-A5CN02	245 (9.65)	408.5 (16.08)	116.5 (4.59)	195 (7.68)	370 (14.57)	22 (0.87)	16.5 (0.65)
FR-A5CN03	245 (9.65)	448.5 (17.66)	116.5 (4.59)	195 (7.68)	410 (16.14)	22 (0.87)	16.5 (0.65)
FR-A5CN04	280 (11.02)	554 (21.81)	122 (4.80)	230 (9.06)	530 (20.87)	12.5 (0.49)	11.5 (0.45)

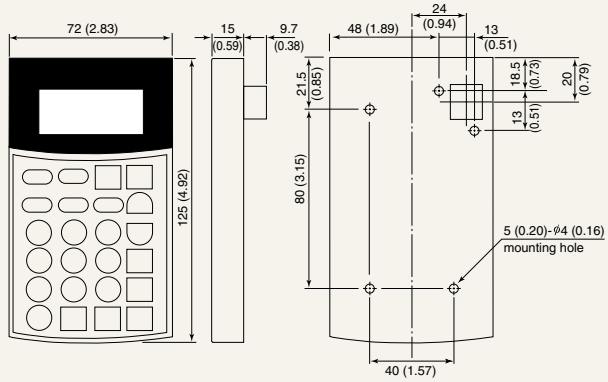
External Dimension Diagrams

Control Panel
FR-DU04



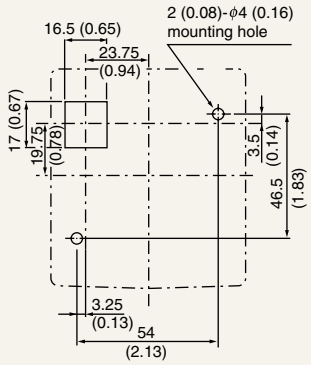
units: mm (inch)

Parameter Unit (option)
FR-PU04



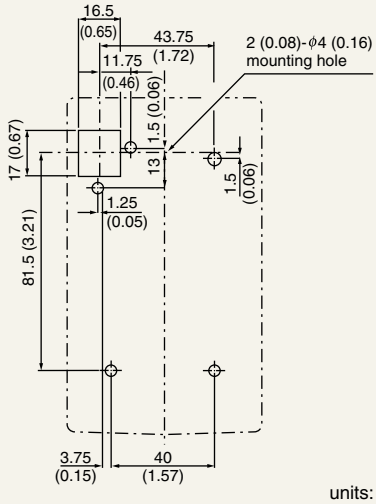
units: mm (inch)

Panel cutaway dimensions



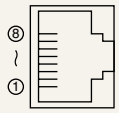
units: mm (inch)

Panel cutaway dimensions



units: mm (inch)

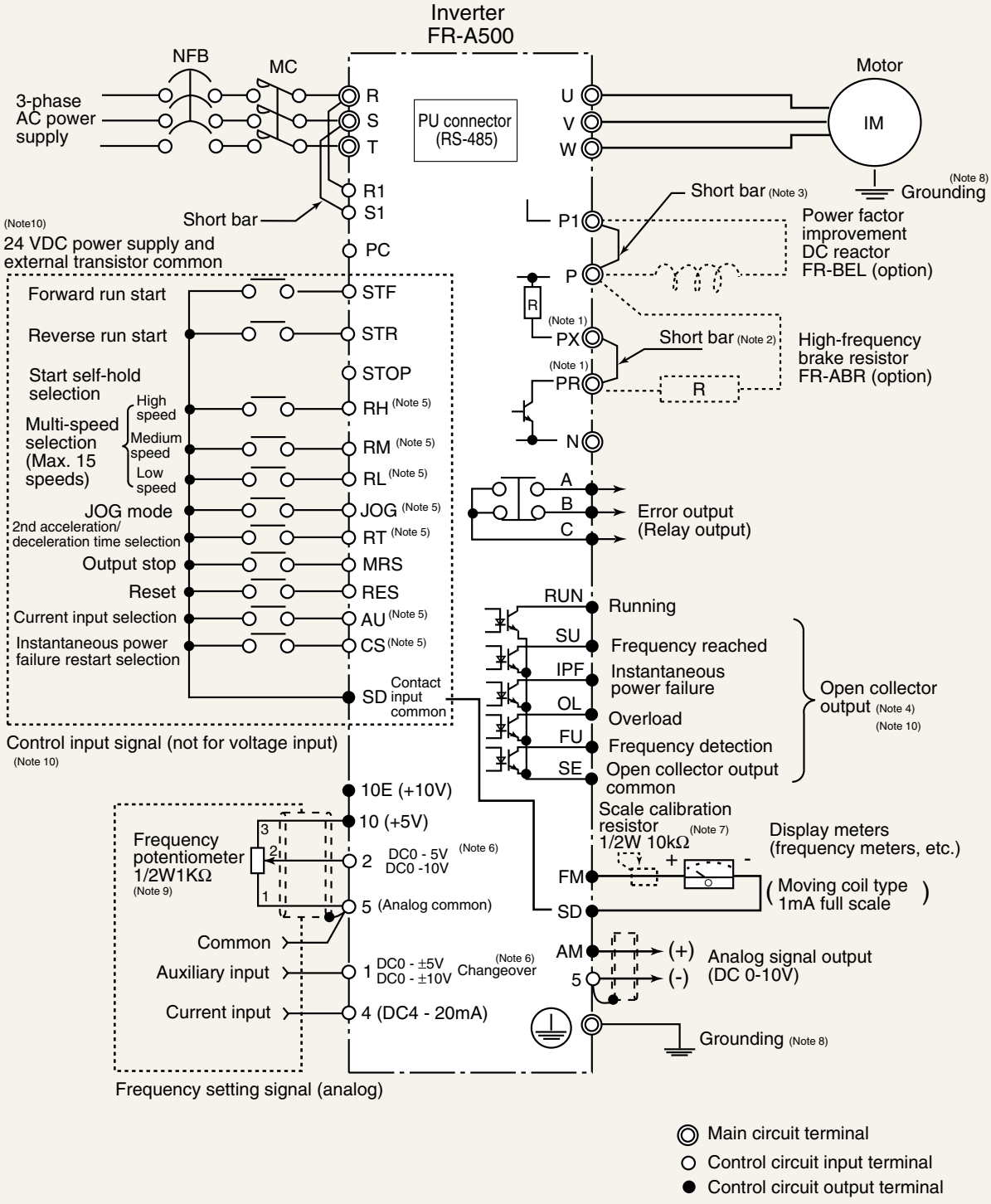
PU connector pin arrangement
(main inverter unit (receptacle side), as seen from the front)



① SG	⑤ SDA
② P5S	⑥ RDB
③ RDA	⑦ SG
④ SDB	⑧ P5S

Notes:
1. Please do not make connections between the PU connector and computer LAN boards, fax modem sockets, or modular connectors for telephones. Since their electrical specifications are different, doing so may damage the unit.
2. Pins ② and ⑧ (P5S) are the power supplies for the control panel and the parameter unit. Please do no use them during communications via the RS-485 interface.

Terminal Connection Diagram



Notes:

(1) Terminals PR and PX are mounted on models FR-A520-0.4 K through 7.5 K and models FR-A540-0.4 K through 7.5 K.
(2) Remove this short bar when using the FR-ABR.
(3) Remove this short bar when using the FR-BEL.
(4) These output terminals can output error alarm codes, or 26 types of function can be individually assigned with Pr. 190 through to 195.
(5) This input terminal can be individually assigned 23 types of function with Pr.180 through to 186.
(6) The input signal can be changed with Pr. 73.
(7) Not required when the meter is calibrated with the control panel.
(8) Always ground the inverter and motor.
(9) 2W1kΩ is recommended when the frequency setting is changed frequently.
(10) This connection diagram is for when the control circuit uses sink logic.

Explanation of Terminal Specifications

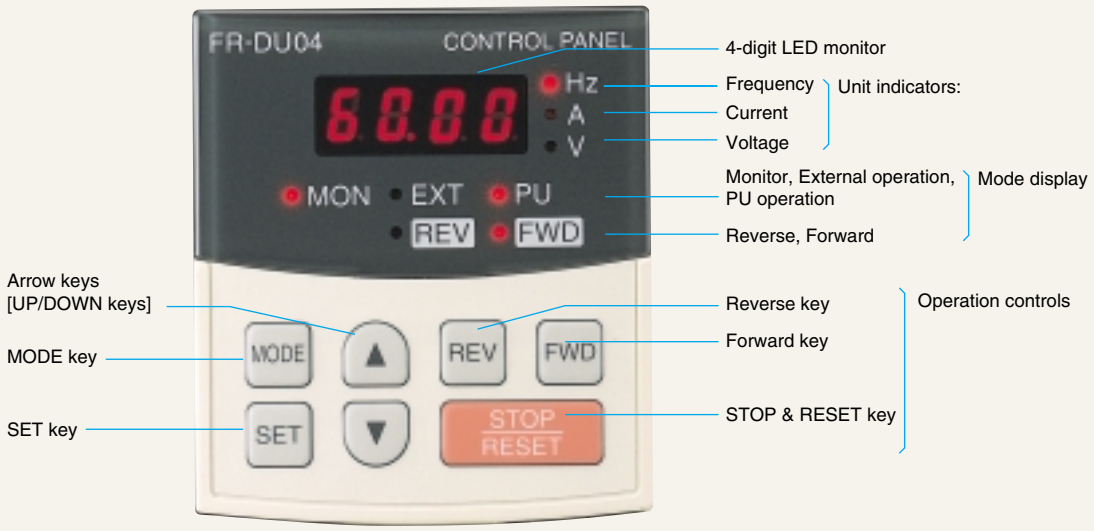
Type		Terminal symbol	Terminal name	Explanation	
Main Circuit		R,S,T	AC power supply input	Connected to the commercial power supply.	
		U,V,W	Inverter output	Connects the 3-phase squirrel cage motor.	
		R1,S1	Control circuit power supply	Connected to the AC power supply terminals R and S. To hold the error display or error output, remove the short bar on the terminal block, and input a power supply to this terminal from an external source.	
		P,PR	Brake resistor connection	Remove the short bar between terminals PX and PR, and connect the optional brake resistor (FR-ABR) between terminals P and PR.	
		P,N	Brake unit connection	Connect the optional FR-BU type brake unit or high-power factor converter (FR-HC).	
		P,P1	Power factor improvement DC reactor connection	Remove the short bar between terminals P and P1, and connect the optional power factor improvement DC reactor (FR-BEL).	
		PR,PX (Note 1)	Built-in brake circuit connection	The built-in brake circuit is enabled when the short bar is connected between terminals PX and PR. (Default setting)	
		⏚	Grounding	This is for grounding the inverter chassis. Always ground the inverter.	
Control Circuit, Input Signals	Contact	STF	Forward run start	Serves as the forward run command when terminals STF-SD (Note 3) are ON. In the programmed operation mode, serves as programmed operations start signal. (Start at ON, stop at OFF)	If terminals STF and STR-SD (Note 3) are ON simultaneously, they serve as the stop command.
		STR	Reverse run start	Serves as the reverse run command when terminals STR-SD (Note 3) are ON.	
		STOP	Start self-hold selection	The self-hold of the start signal is selected when terminals STOP-SD (Note 3) are ON.	
		RH, RM, RL	Multi-speed selection	The multi-speed can be selected with a combination of ON/OFF commands between the terminals RH, RM and RL-SD (Note 3).	The terminal function changes according to the input terminal function selection (Pr. 180 through 186).
		JOG	JOG mode selection	JOG operation is selected when terminals JOG-SD (Note 3) are ON, and JOG operation can be started with the start signal (STF or STR), or control panel.	
		RT	2nd acceleration/ deceleration time selection	The 2nd acceleration/deceleration time is selected when terminals RT-SD (Note 3) are ON. If other 2nd functions such as "2nd torque boost" or "2nd V/F (base frequency)" are set, these functions will be selected when terminals RT-SD are ON.	
		MRS	Output stop	Inverter output stops when terminals MRS-SD (Note 3) are ON (for 20 ms or more). This is used to cut off the inverter output when stopping the motor with a magnetic brake.	
		RES	Reset	This is used to cancel the hold state when the protection circuit activates. Turn ON terminals RES-SD (Note 3) for 0.1 sec., or more, and then turn OFF.	
		AU	Current input selection	Operation is possible with the frequency setting signal 4 to 20 mA DC only when terminals AU-SD (Note 3) are ON.	The terminal function changes according to the input terminal function selection (Pr. 180 through 186).
		CS	Instantaneous power failure restart selection	If terminals CS-SD (Note 3) are ON, the motor will restart automatically when the power is restored. However, to use this operation, restart must be enabled. (Restart is disabled as the default setting.)	
		SD	Contact input common (sink)	This is the common terminal for the terminal FM and for the contact input terminal during sink logic. It is insulated from the control circuit's common terminals.	
		PC	24 VDC power supply, external transistor common and contact input common (source)	When connecting a transistor output (open collector output) such as a programmable logic controller (PLC), malfunctions caused by supplied current can be prevented by connecting the external power common for the transistor output to this terminal. It is possible to use 24 VDC 0.l A as the power supply. When source logic is selected, this is the common terminal for the contact input terminal.	
Analog	Frequency setting	10E	Frequency setting power supply	10 VDC tolerable load current 10 mA	When connecting a potentiometer at the default setting, connect to terminal 10. To connect to terminal 10E, change the input specifications for terminal 2.
		10		5 VDC tolerable load current 10 mA	
		2	Frequency setting (voltage)	When 0 to 5 VDC (or 0 to 10 V) is input, the max. output frequency is reached at 5 V (10 V). The input and output are proportional. The inputs 0 to 5 VDC (default setting) and 0 to 10 VDC are changed using Pr. 73. Input resistance 10 Ω max., tolerable voltage 20V.	
		4	Frequency setting	When 4 to 20 mA DC is input, the max. output frequency is reached at 20 mA. The input and output are proportional. This input signal is enabled only when terminals AU-SD (Note 3) are ON. The input resistance 250 Ω max., tolerable current 30 mA	
		1	Auxiliary frequency setting	When 0 to ±5 VDC or 0 to ±10 V is input, this signal is added to the terminal 2 or 4 frequency setting signal. The inputs 0 to ±5 VDC or 0 to ±10 V (default setting) are changed using Pr 73. Input resistance 10 Ω max., tolerable voltage ±20V	
		5	Frequency setting common	This is the common terminal for the frequency setting signal (terminal 2, 1 or 4) and analog output terminal AM. This terminal is not insulated from the control circuit's common terminals. Do not ground this common.	
Control Circuit Output Signal	Cont-act	A,B,C	Error output	This is a 1c relay output that indicates that the inverter's protection circuit has functioned and the output has stopped. 200 VAC 0.3 A, 30 VDC 0.3A. When an error occurs, there is non-continuity between B-C (continuity between A-C); in normal operations, there is continuity between B-C (non-continuity between A-C).	The terminal function changes according to the output terminal function selection (Pr. 190 to 195).
	Open collector	RUN	Inverter running	L level is output when the inverter output frequency is higher than the starting frequency (default: 0.5 Hz, changeable), and the H level is set when stopped or during DC braking (Note 2). Tolerable load: 24 VDC 0.l A	
		SU	Frequency reached	The L level is set when the output frequency is within ±10% (default, changeable) of the set frequency, and the H level is set during acceleration/deceleration and when stopped (Note 2). Tolerable load: 24V DC 0.lA	
		OL	Overload warning	The L level is output when stall prevention is activated by the stall prevention function, and the H level is set when stall prevention is canceled (Note2). Tolerable load: 24 VDC 0.l A	
		IPF	Instantaneous power failure	The L level is output when the instantaneous power failure or undervoltage protection has functioned (Note 2). Tolerable load: 24 VDC 0.1 A	
		FU	Frequency detection	The L level is output when the output frequency is higher than the set detection frequency, and the H level is output when it is lower (Note 2). Tolerable load: 24 VDC 0.1 A	
		SE	Open collector output common	This is the common terminal for the terminals RUN, SU, OL, 1PF and FU. It is insulated from the control circuit's common terminals.	
	Pulse	FM	For display meter	One of 16 monitor items, such as output frequency, is selected and output. The output signal is proportional to the size of each monitor item.	Default output item: frequency; tolerable load current 1 mA l,440 pulse/sec. at 60 Hz
	Analog	AM	Analog signal output		Default output item: frequency; output signal 0 to 10 VDC, tolerable load current 1 mA
Commu-nications	RS-485	–	PU connector	RS-485 communications can be carried out using the control panel connector. Compliance standards: EIA Standard RS-485. Transmission format: multidrop link method. Communication rate: max. 19200 baud. Total length: 500 m (1,640.4 ft).	

Notes:
1. Terminals PR and PX are mounted on models FR-A520-0.4 K through 7.5 K, and on models FR-A540-0.4 K through 7.5 K.
2. The L level indicates when the open connector output transistor turns ON (continuity state). The H level indicates when it is in the OFF state (non-continuity state).
3. When using source logic, the terminal PC will be the common terminal, not SD.

Explanation of Control Panel

Control Panel FR-DU04

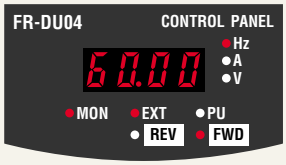
External View



Note: The Control Panel is standard equipment, and may be detached.

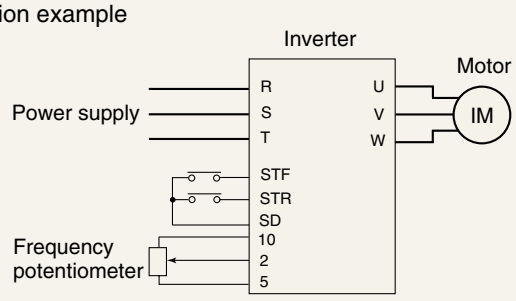
External Operation

When a Start or Frequency instruction is sent from the control terminal.



The monitor display during forward run at 60Hz.

Connection example



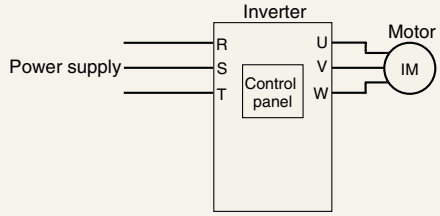
Simultaneous PU/External Operations

Simultaneous control panel (FR-DU04), parameter unit (FR-PU04) and external operations is possible by setting Pr. 79.

PU Operation (PU: control panel, parameter unit)

When the unit is operated from the control panel.

Connection example



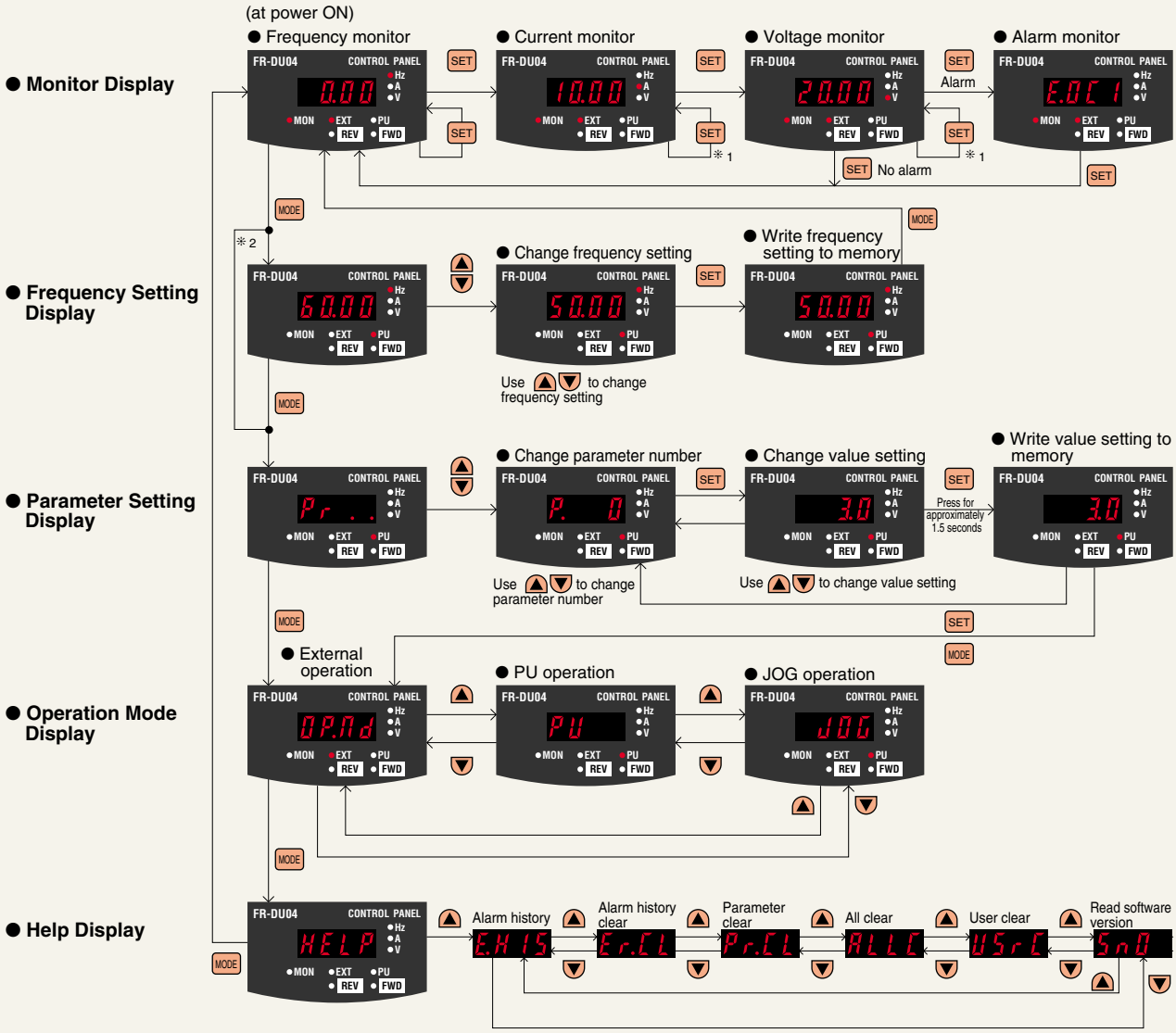
(1) Press [MODE] key

(2) Set the desired operating frequency using the arrow keys
eg. In the case of 60Hz, press ▲ (or ▼) [SET]

(3) Press [FWD] (or [REV]) key.
The motor starts.

(4) Press [STOP] key. The motor stops.

Key Operations Using the Control Panel



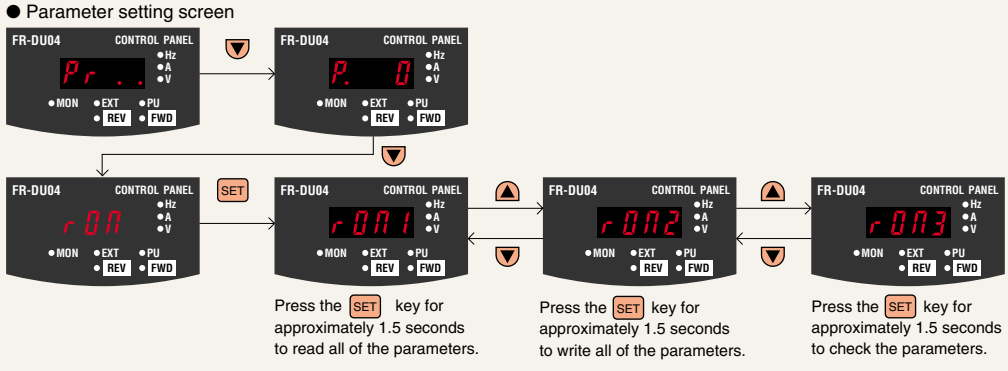
*1 If SET is pressed continuously for approximately 1.5 seconds, the current display switches to the initial power ON display.

*2 During external operations, the frequency setting display does not appear.

Copying Parameters

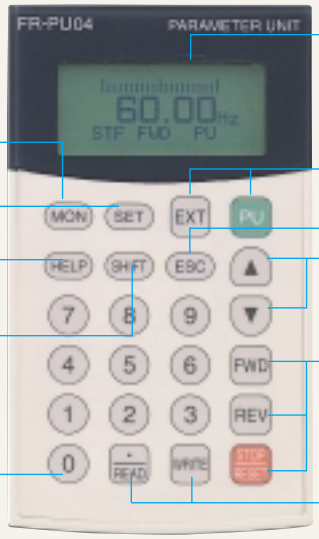
Parameter settings can be copied to another inverter (excluding non-FR-A500 series inverters) by using the FR-DU04 operation panel or the FR-PU04 parameter unit. First, all of the parameters on the source inverter are read, the operation panel is connected to the target inverter, and all of the parameters are then written to the inverter.

● Parameter setting screen



Explanation of Parameter Unit

Parameter Unit FR-PU04



Monitor mode select key

Setting mode select key

HELP mode select key

SHIFT key

Function and number keys (0~9)

Monitor screen
- Wide backlit LCD (13 characters x 4 line display)
- Interactive parameter setting
- Help function, troubleshooting guidance
- 21 types of monitor (frequency, current, voltage, etc.)

Operation mode selection key

Escape key

Keys for changing frequency

Operation instruction keys
- Used when issuing Forward, Reverse and STOP instructions (STOP key issues RESET instruction when an alarm is generated)

READ and WRITE keys

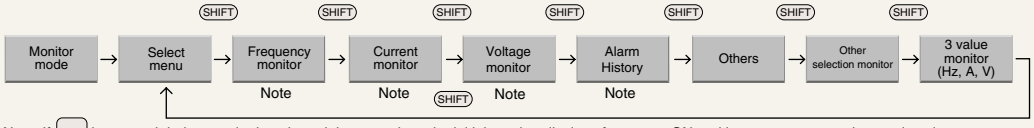
The FR-PU04 attached to the main inverter unit

Operating the parameter unit is basically the same as operating the earlier FR-PU02E unit.

Note: The Parameter Unit is optional equipment.

● Monitor:

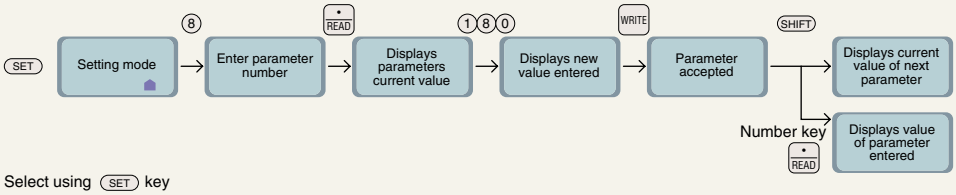
Press the (SHIFT) key repeatedly to call up 5 types of monitor



Note: If (WRITE) is pressed during monitoring, the unit is set to show the initial monitor display after power ON and inverter set, or monitor mode select.

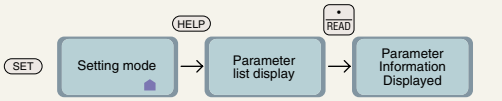
● Parameter Set:

Selected using the (SET) key
Enter the parameter setting value
Eg. Set Parameter 8 (deceleration time) setting to 180 seconds:



● Parameter List

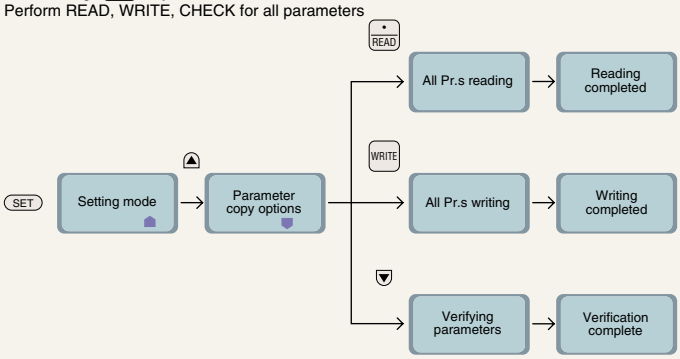
Select using (SET) key



(i.e. Pr.0 set display)

● All Operations

Select using (SET) key
Perform READ, WRITE, CHECK for all parameters



List of Parameters

Function	Pr. No.	Name	Setting range	Minimum setting	Default setting
Basic functions	0	Torque boost (Note 2)	0 - 30%	0.1%	6%/4%/3%/2%(Note 1)
	1	Maximum frequency	0 - 120Hz	0.01Hz	120Hz
	2	Minimum frequency	0 -120Hz	0.01Hz	0Hz
	3	Base frequency	0 - 400Hz	0.01Hz	60Hz
	4	Multi-speed setting (high speed)	0 - 400Hz	0.01Hz	60Hz
	5	Mult-speed setting (middle speed)	0 - 400Hz	0.01Hz	30Hz
	6	Mult-speed setting (low speed)	0 - 400Hz	0.01Hz	10Hz
	7	Acceleration time	0 - 3600 sec./0 - 360 sec.	0.1 sec./0.01 sec.	5 sec./15 sec. (Note 3)
	8	Deceleration time	0 - 3600 sec./0 - 360 sec.	0.1 sec./0.01 sec.	5 sec./15 sec. (Note 3)
	9	Electronic thermal O/L relay	0 - 500A	0.01A	Rated output current
Standard operation functions	10	DC injection brake operation frequency	0 - 120Hz, 9999	0.01Hz	3Hz
	11	DC injection brake operation time	0 - 10 sec., 8888	0.1 sec.	0.5 sec.
	12	DC injection brake voltage	0 - 30%	0.1%	4%/2%(Note 3)
	13	Starting frequency	0 - 60Hz	0.01Hz	0.5Hz
	14	Load pattern selection (Note 2)	0 - 5	1	0
	15	JOG frequency	0 - 400Hz	0.01Hz	5Hz
	16	JOG acceleration/deceleration time	0 - 3600 sec./0 - 360 sec.	0.1 sec./0.01 sec.	0.5 sec.
	17	MRS input selection	0, 2	1	0
	18	High speed maximum frequency	120 - 400Hz	0.01Hz	120Hz
	19	Base frequency voltage (Note 2)	0 - 1000V, 8888, 9999	0.1V	9999
	20	Acceleration/deceleration reference frequency	0 - 400Hz	0.01Hz	60Hz
	21	Acceleration/deceleration time increments	0, 1	1	0
	22	Stall prevention operation level	0 - 200%, 9999	0.1%	150%
	23	Stall prevention operation at double speed	0 - 200%, 9999	0.1%	9999
	24	Multi-speed setting (4 speed)	0 - 400Hz, 9999	0.01Hz	9999
	25	Multi-speed setting (5 speed)	0 - 400Hz, 9999	0.01Hz	9999
	26	Multi-speed setting (6 speed)	0 - 400Hz, 9999	0.01Hz	9999
	27	Multi-speed setting (7 speed)	0 - 400Hz, 9999	0.01Hz	9999
	28	Multi-speed input compensation	0, 1	1	0
	29	Acceleration/deceleration pattern	0, 1, 2, 3	1	0
	30	Regenerative function selection	0, 1, 2	1	0
	31	Frequency jump 1A	0 - 400Hz, 9999	0.01Hz	9999
	32	Frequency jump 1B	0 - 400Hz, 9999	0.01Hz	9999
	33	Frequency jump 2A	0 - 400Hz, 9999	0.01Hz	9999
	34	Frequency jump 2B	0 - 400Hz, 9999	0.01Hz	9999
	35	Frequency jump 3A	0 - 400Hz, 9999	0.01Hz	9999
	36	Frequency jump 3B	0 - 400Hz, 9999	0.01Hz	9999
	37	Speed display	0, 1 - 9998	1	0
Output terminal functions	41	Up to frequency sensitivity	0 - 100%	0.1%	10%
	42	Output frequency defection	0 - 400Hz	0.01Hz	6Hz
	43	Output frequency defection during reverse rotation	0 - 400Hz, 9999	0.01Hz	9999
2nd functions	44	2nd acceleration/deceleration time	0 - 3600 sec./0 - 360 sec.	0.1 sec./0.01 sec.	5 sec.
	45	2nd deceleration time	0 - 3600 sec./0 - 360 sec., 9999	0.1 sec./0.01 sec.	9999
	46	2nd torque boost (Note 2)	0 - 30%, 9999	0.1%	9999
	47	2nd V/F (base frequency) (Note 2)	0 - 400Hz, 9999	0.01Hz	9999
	48	2nd stall prevention operation current (Note 12)	0 - 200%	0.1%	150%
	49	2nd stall prevention operation frequency (Note 12)	0 - 400Hz, 9999	0.01Hz	0
	50	2nd output frequency detection	0 - 400Hz	0.01Hz	30Hz
Display functions	52	DU/PU main display data selection	0 - 20, 22, 23, 24, 25, 100	1	0
	53	Parameter for FR-PU04	Refer the instruction manual for the detail.		
	54	FM terminal function selection	1 - 3, 5 - 14, 17, 18, 21	1	1
	55	Frequency monitor reference	0 - 400Hz	0.01Hz	60Hz
	56	Current monitor reference	0 - 500A	0.01A	Rated output current
Restart	57	Restart coasting time	0, 0.1 - 5 sec., 9999	0.1 sec.	9999
	58	Restart cushion time	0 - 60 sec.	0.1 sec.	1.0 sec.
Supplementary functions	59	Remote setting function selection	0, 1, 2	1	0

Function	Pr. No.	Name	Setting range	Minimum setting	Default setting
Operation selection functions	60	Intelligent mode selection (Note 12)	0 - 8	1	0
	65	Retry selection	0 - 5	1	0
	66	Stall prevention operation reduction starting frequency (Note 12)	0 - 400Hz	0.01Hz	60Hz
	67	Number of retries at alarm occurrence	0 - 10, 101 - 110	1	0
	68	Retry waiting time	0 - 10 sec.	0.1 sec.	1 sec.
	69	Retry count display ensure	0	—	0
	70	Special regenerative brake duty	0 - 15%/0 - 30%/0%(Note 5)	0.1%	0%
	71	Applied motor (Note 12)	0 - 8, 13 - 18, 20, 23, 24	1	0
	72	PWM frequency selection	0 - 15	1	2
	73	0 - 5V, 0 - 10V selection	0 - 5, 10 - 15	1	1
	74	Filter time constant selection	0 - 8	1	1
	75	Reset selection/PU disconnected/PU	0 - 3, 14 - 17	1	14
	76	Alarm code output selection	0, 1, 2, 3	1	0
	77	Parameter write disable selection	0, 1, 2	1	0
	78	Reverse rotation prevention selection	0, 1, 2	1	0
	79	Operation mode selection (Note 12)	0 - 8	1	0
Motor constants	80	Motor capacity (Note 12)	0.4 - 55kW, 9999	0.01kW	9999
	81	Number of motor poles (Note 12)	2, 4, 6, 12, 14, 16, 9999	1	9999
	82	Motor excitation current (Note 12)	0 - 9999	1	9999
	83	Rated motor voltage (Note 12)	0 - 1000V	0.1V	200V (Note 6)
	84	Rated motor frequency (Note 12)	50 - 120Hz	0.01Hz	60Hz
	89	Speed control gain (Note 10)	0 - 1000.0%	0.1%	100%
	90	Motor constant (R1) (Note 10)	(Note 10)	(Note 10)	9999
	91	Motor constant (R2) (Note 10)	(Note 10)	(Note 10)	9999
	92	Motor constant (L1) (Note 10)	(Note 10)	(Note 10)	9999
	93	Motor constant (L2) (Note 10)	(Note 10)	(Note 10)	9999
	94	Motor constant (X) (Note 10)	(Note 10)	(Note 10)	9999
	95	Online auto-tuning selection (Note 12)	0, 1	1	0
	96	Auto-tuning setting/status (Note 12)	0, 1, 101	1	0
VF 5 points adjustable	100	V/F1 (1st frequency) (Note 2, 12)	0 - 400Hz, 9999	0.01Hz	9999
	101	V/F1 (1st frequency voltage) (Note 2, 12)	0 - 1000V	0.1V	0
	102	V/F2 (2nd frequency) (Note 2, 12)	0 - 400Hz, 9999	0.01Hz	9999
	103	V/F2 (2nd frequency voltage) (Note 2, 12)	0 - 1000V	0.1V	0
	104	V/F3 (3rd frequency) (Note 2, 12)	0 - 400Hz, 9999	0.01Hz	9999
	105	V/F3 (3rd frequency voltage)(Note 2, 12)	0 - 1000V	0.1V	0
	106	V/F4 (4th frequency)(Note 2, 12)	0 - 400Hz, 9999	0.01Hz	9999
	107	V/F4 (4th frequency voltage) (Note 2, 12)	0 - 1000V	0.1V	0
	108	V/F5 (5th frequency) (Note 2, 12)	0 - 400Hz, 9999	0.01Hz	9999
	109	V/F5 (5th frequency voltage)(Note 2, 12)	0 - 1000V	0.1V	0
3rd functions	110	3rd acceleration/ deceleration time	0 - 3600/0 - 360 sec., 9999	0.1 sec./0.01 sec.	9999
	111	3rd deceleration time	0 - 3600/0 - 360 sec., 9999	0.1 sec./0.01 sec.	9999
	112	3rd torque boost (Note 2)	0 - 30.0%, 9999	0.1%	9999
	113	3rd V/F (base frequency) (Note 2)	0 - 400Hz, 9999	0.01Hz	9999
	114	3rd stall prevention operation current	0 - 200%	0.1%	150%
	115	3rd stall prevention operation frequency	0 - 400Hz	0.01Hz	0
	116	3rd output frequency detection	0 - 400Hz, 9999	0.01Hz	9999
Communications functions	117	Station number	0 - 31	1	0
	118	Communication speed	48, 96, 192	1	192
	119	Stop bit length/data length	0,1 (data length 8) 10, 11 (data length 7)	1	1
	120	Parity check presence/absence	0, 1, 2	1	2
	121	Number of communication retries	0 - 10, 9999	1	1
	122	Communication check time interval	0, 0.1 - 999.8 sec., 9999	0.1	0
	123	Wait time setting	0 - 150ms, 9999	10ms	9999
	124	CR/LF absence/presence selection	0, 1, 2	1	1

List of Parameters

Function	Pr. No.	Name	Setting range	Minimum setting	Default setting
PID control	128	PID action selection	10, 11, 20, 21	—	10
	129	PID proportional band	0.1 - 1000%, 9999	0.1%	100%
	130	PID integral time	0.1 - 3600sec., 9999	0.1sec.	1 sec.
	131	Upper limit	0 - 100%, 9999	0.1%	9999
	132	Lower limit	0 - 100%, 9999	0.1%	9999
	133	PID action set point for PU operation	0 - 100%	0.01%	0%
	134	PID differential time	0.01 - 10.00sec., 9999	0.01 sec.	9999
Commercial power supply switchover	135	Commercial power supply switchover sequence output terminal selection (Note 12)	0, 1	1	0
	136	MC switchover interlock time (Note 12)	0 - 100.0sec.	0.1 sec.	1.0 sec.
	137	Start waiting time (Note 12)	0 - 100.0sec.	0.1 sec.	0.5 sec.
	138	Commercial power supply-inverter switchover selection at alarm occurrence (Note 12)	0, 1	1	0
	139	Automatic inverter-commercial power supply switch-over selection at alarm occurrence	0 - 60.00Hz, 9999	0.01Hz	9999
Backlash	140	Backlash acceleration stopping frequency (Note 11)	0 - 400Hz	0.01Hz	1.00Hz
	141	Backlash acceleration stopping time (Note 11)	0 - 360 sec.	0.1 sec.	0.5 sec.
	142	Backlash deceleration stopping frequency (Note 11)	0 - 400Hz	0.01Hz	1.00Hz
	143	Backlash deceleration stopping time (Note 11)	0 - 360%	0.1 sec.	0.5 sec.
Display	144	Speed setting switchover	0, 2, 4, 6, 8, 10, 102, 104, 106, 108, 110	1	4
Supplementary functions	148	Stall prevention level at 0 V input	0 - 200%	0.1%	150%
	149	Stall prevention level at 10 V input	0 - 200%	0.1%	200%
Current detection	150	Output current detection level	0 - 200%	0.1%	150%
	151	Output current detection period	0 - 10 sec.	0.1 sec.	0
	152	Zero current detection level	0 - 200.0%	0.1%	5.0%
	153	Zero current detection period	0 - 1 sec.	0.01 sec.	0.5 sec.
Auxiliary functions	154	Voltage reduction selection during stall prevention operation	0, 1	1	1
	155	RT activated condition	0, 10	1	0
	156	Stall prevention operation selection	0 - 31, 100	1	0
	157	OL signal waiting time	0 - 25 sec., 9999	0.1 sec.	0
	158	AM terminal function selection	1 - 3, 5 - 14, 17, 18, 21	1	1
Supplementary functions	160	User group read selection	0, 1, 10, 11	1	0
Restart	162	Automatic restart after instantaneous failure selection	0, 1	1	0
	163	First cushion time for restart	0 - 20 sec.	0.1 sec.	0 sec.
	164	First cushion voltage for restart	0 - 100%	0.1%	0%
	165	Restart stall prevention operation level	0 - 200%	0.1%	150%
Initial monitor	170	Watt-hour meter clear	0	—	0
	171	Actual operation hour meter clear	0	—	0
User functions	173	User group 1 registration	0 - 999	1	0
	174	User group 1 deletion	0 - 999, 9999	1	0
	175	User group 2 registration	0 - 999	1	0
	176	User group 2 deletion	0 - 999, 9999	1	0
Terminal function selection	180	RL terminal function selection	0 - 99, 9999	1	0
	181	RM terminal function selection	0 - 99, 9999	1	1
	182	RH terminal function selection	0 - 99, 9999	1	2
	183	RT terminal function selection	0 - 99, 9999	1	3
	184	AU terminal function selection	0 - 99, 9999	1	4
	185	JOG terminal function selection	0 - 99, 9999	1	5
	186	CS terminal function selection	0 - 99, 9999	1	6
	190	RUN terminal function selection	0 - 199, 9999	1	0
	191	SU terminal function selection	0 - 199, 9999	1	1
	192	IPF terminal function selection	0 - 199, 9999	1	2
	193	OL terminal function selection	0 - 199, 9999	1	3
	194	FU terminal function selection	0 - 199, 9999	1	4
	195	A.B.C terminal function selection	0 - 199, 9999	1	99
Supplementary functions	199	User initial value setting	0 - 999, 9999	1	0
Program operations	200	Program minute/second selection	0 - 3	1	0
	201	Program set 1 1 - 10	0 - 2: direction of rotation 0 - 400, 9999: frequency 0 - 99, 59: time	1 0.1 Hz Min. or sec.	0 9999 0
	211	Program set 2 11 - 20	0 - 2: direction of rotation 0 - 400, 9999: frequency 0 - 99, 59: time	1 0.1 Hz Min. or sec.	0 9999 0
	221	Program set 3 21 - 30	0 - 2: direction of rotation 0 - 400, 9999: frequency 0 - 99, 59: time	1 0.1 Hz Min. or sec.	0 9999 0
	231	Time-of-day setting	0 - 99.59	—	0

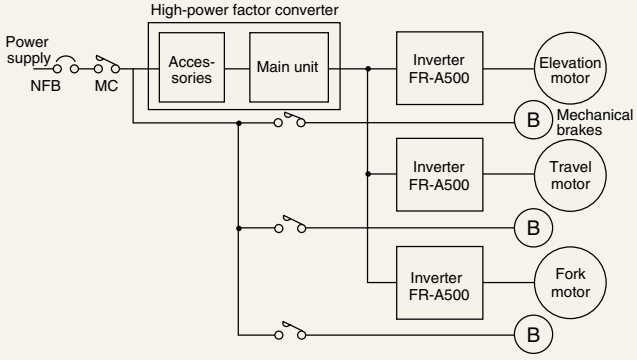
List of Parameters

Function	Pr. No.	Name	Setting range		Minimum setting	Default setting	
Multi-speed operations	232	Multi-speed setting (speed 8)	0 - 400Hz, 9999		0.01Hz	9999	
	233	Multi-speed setting (speed 9)	0 - 400Hz, 9999		0.01Hz	9999	
	234	Multi-speed setting (speed 10)	0 - 400Hz, 9999		0.01Hz	9999	
	235	Multi-speed setting (speed 11)	0 - 400Hz, 9999		0.01Hz	9999	
	236	Multi-speed setting (speed 12)	0 - 400Hz, 9999		0.01Hz	9999	
	237	Multi-speed setting (speed 13)	0 - 400Hz, 9999		0.01Hz	9999	
	238	Multi-speed setting (speed 14)	0 - 400Hz, 9999		0.01Hz	9999	
	239	Multi-speed setting (speed 15)	0 - 400Hz, 9999		0.01Hz	9999	
Auxiliary functions	240	Soft-PWM setting	0, 1		1	1	
	244	Cooling fan operation selection	0, 1		1	0	
Stop selection functions	250	Stop selection time	0 - 100 sec., 9999		0.1sec.	9999	
Power failure stop functions	261	Power failure stop selection	0, 1		1	0	
	262	Subtraction frequency at deceleration start	0 - 20Hz		0.01Hz	3Hz	
	263	Subtraction starting frequency	0 - 120Hz, 9999		0.01Hz	60Hz	
	264	Power failure deceleration time 1	0 - 3600/0 - 360 sec.		0.1sec./0.01sec.	5sec.	
	265	Power failure deceleration time 2	0 - 3600/0 - 360 sec., 9999		0.1sec./0.01sec.	9999	
	266	Power failure deceleration time switchover frequency	0 - 400Hz		0.01Hz	60Hz	
Function selection	270	Stop on contact/load torque high speed frequency control selection	0, 1, 2, 3		1	0	
Load torque high speed frequency control	271	High speed setting maximum current	0 - 200%		0.1%	50%	
	272	Medium speed setting minimum current	0 - 200%		0.1%	100%	
	273	Current averaging range	0 - 400Hz, 9999		0.01Hz	9999	
	274	Current averaging filter time constant	1 - 4000		1	16	
Stop on contact control	275	Stop on contact exciting current low-speed multiplying factor (Note 9)	1 - 1000%, 9999		1%	9999	
	276	Stop on contact PWM carrier frequency (Note 9)	0 - 15, 9999		1	9999	
Brake sequence functions	278	Brake opening frequency (Note 7)	0 - 30Hz		0.01Hz	3Hz	
	279	Brake opening current (Note 7)	0 - 200%		0.1%	130%	
	280	Brake opening current detection time (Note 7)	0 - 2 sec.		0.1 sec.	0.3 sec.	
	281	Brake operation time at start (Note 7)	0 - 5 sec.		0.1 sec.	0.3 sec.	
	282	Brake closing frequency (Note 7)	0 - 30Hz		0.01Hz	6Hz	
	283	Brake operation time at stop (Note 7)	0 - 5 sec.		0.1 sec.	0.3 sec.	
	284	Deceleration detection function selection (Note 7)	0, 1		1	0	
	285	Over-speed detection frequency	0 - 30Hz, 9999		0.01Hz	9999	
Supplementary functions	300~	Parameters for inboard options	Refer the option instruction manual for details.				
Calibration functions	900	FM terminal calibration	–		–		
	901	AM terminal calibration	–		–		
	902	Frequency setting voltage bias	0 - 10V	0 - 60Hz	0.01Hz	0V	0Hz
	903	Frequency setting voltage gain	0 - 10V	1 - 400Hz	0.01Hz	5V	60H
	904	Frequency setting current bias	0 - 20mA	0 - 60Hz	0.01Hz	4mA	0Hz
	905	Frequency setting current gain	0 - 20mA	1 - 400Hz	0.01Hz	20mA	60H
Supplementary functions	990	Buzzer control	0, 1		1	1	
	991	Parameter for FR-PU04	Refer the FR-PU04 instruction manual for details.				

Notes:
1. Setting values differ according to inverter capacity. The setting values are: (0.4K, 0.75K)/(1.5K~3.7K)/(5.5K, 7.5K)/(11K and over).
2. When the advanced flux vector control mode is selected, the setting is ignored.
3. Setting values differ according to inverter capacity. The setting values are: (7.5K and below)/(11K and over).
4. The set values for the parameters in the shaded areas ▢ can be altered during operations even if Pr. 77 (Parameter write disable) is set to 0 (default setting).
5. Setting ranges differ according to inverter capacity. The setting ranges are: (0.4K~1.5)/(2.2K~7.5K)/(11K and over).
6. The default setting for 400V class units is 400V.
7. Pr. 80,81≠9999, Pr. 60=7,8 settings possible.
8. Pr. 80,81≠9999, Pr. 77=801 settings possible.
9. Pr. 270=1,3, Pr. 80,81≠9999 settings possible.
10. The setting range and minimum setting unit differ according to the value set for Pr. 71 (Applicable motor). For further information, please consult the manual.
11. Reading and writing are possible when Pr. 29=3.
12. Even if Pr. 77 (Parameter write disable) is set to 2, the set value cannot be changed during operations.

Applications

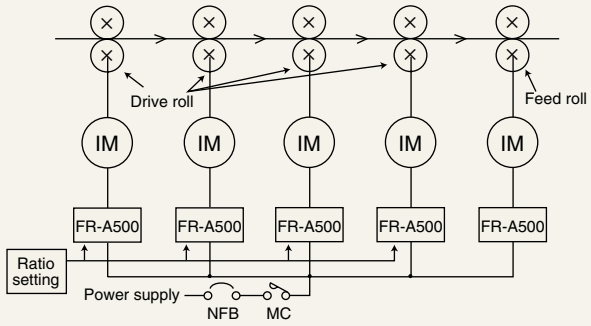
High-speed Crane or Lift



- Thanks to the wide-range speed control, high-speed operation is possible without any decline in stopping precision.
- A brake unit is not required because a power regeneration function is provided.
- Since elevation and travel are performed simultaneously, the high-power factor converter should be selected according to the capacity of the elevation motor plus the capacity of the travel motor.
- The mechanical brake power supply is connected to the power supply of the high-power factor converter.
- The mechanical brakes can be applied with optimal timing using the brake sequence function.
- The large starting torque allows powerful performance in lifting operations.

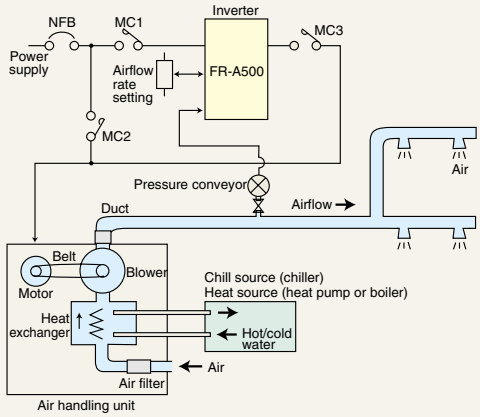
Line control

< Intermediate axis control using draw control >



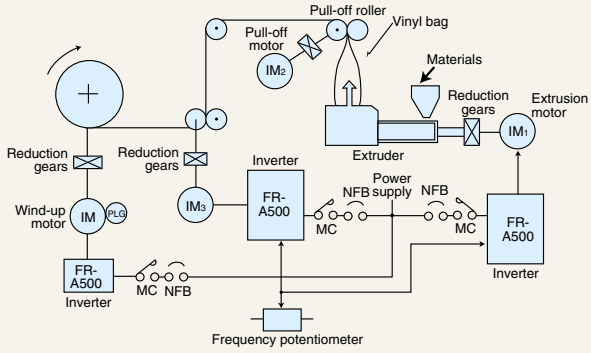
- Since advanced flux vector control offers high operational precision, it is possible to alter the speed of each roll slightly during draw control operations.
- Driving the rear stage rolls at slightly higher speeds than the front stage rolls allowing stable operation in which tension is maintained at a rate that matches the elongation rate of the material.
- When the on-line auto tuning function is selected, the motor constants are automatically tuned each time the motor starts, eliminating speed variations caused by temperature fluctuations and providing stable control.

Air-conditioning Fan



- Because of the PID control function built into the inverter, constant temperature control operation is possible.
- MCl-MC3 operation timing can be controlled with optimum precision using the inverter's built-in commercial power supply switchover sequence function. The external switchover sequence circuit is also simplified.
- An electromechanical interlock that prevents MC2 and MC3 from being turned ON simultaneously is required.
- The inverter controls temperature constantly during operation, creating a pleasant environment and conserving energy.

Extruder



- The frequencies for the two inverters used for extrusion and pull-off can be set with one frequency potentiometer. The ratio between the operational frequencies of the two inverters is adjusted for the bias and gain (Pr. 902 and 903) of the input frequency signal.
- Advanced flux vector control (on-line auto tuning) makes it possible to carry out operations with minimal speed fluctuation. As a result, extrusion pressure can be accurately controlled according to the differences in the materials being extruded.
- Using a PLG on the wind-up motor allows even more precise control of operations.

Protective Functions

Except for the motor's electronic thermal relay, the following functions are provided for the protection of the inverter itself, but they may also function when the inverter breaks down.

Function name		Description		Display	Type (Note3) Major fault	Type (Note3) Minor fault
Over-current cut-off		When the inverter output current exceeds the rated current by more than approximately 200% during acceleration/deceleration or at constant speed, the protective circuit activates, halting inverter output.	Accelerating	E.OC1	●	
			Constant speed	E.OC2		
			Decelerating	E.OC3		
Regenerative overvoltage cut-off		If the DC voltage in the inverter's internal main circuit exceeds the rated value as a result of regenerative energy generated through motor braking during acceleration/deceleration or at constant speed, the protective circuit activates, halting inverter output. There are also cases where it is activated by surge voltage generated in the power supply system.	Accelerating	E.OV1	●	
			Constant speed	E.OV2		
			Decelerating	E.OV3		
Overload cut-off (electronic thermal relay)	Motor	The electronic thermal relay inside the inverter detects motor overheating resulting from overloading or a decline in cooling capacity at constant speed, activating the protective circuit and halting inverter output. The electronic thermal relay cannot protect multipolar and other special motors, or several motors working together, so a thermal relay should be installed on the inverter's output side.		E.THM	●	
	Inverter	In the case where a current flows that is at least 150% of the rated output current but does not exceed the overcurrent cut-off (OC) level (200% max.), the electronic thermal relay activates according to reverse time characteristics to protect the main circuit transistors, and halts inverter output. (150% of overload capacity, 60 seconds.)		E.THT	●	
Instantaneous power failure protection		When the power fails for more than 15ms and is restored within approximately 100ms, the instantaneous power failure protection function activates to prevent erroneous operation of the control circuit, and halts inverter output. At this time, error warning output contacts open (between terminals A and C) and close (between terminals B and C) (Note 4). If the power failure continues for 100ms or more, the error warning output does not activate, and if the start signal is ON when power is restored, the inverter restarts. (If the instantaneous power failure lasts for less than 15msec, the control circuit functions normally.)		E.IPF	●	
Undervoltage protection		(1) If the inverter's supply voltage drops, the control circuit can no longer fulfill its normal functions. Moreover, the motor suffers from insufficient torque and overheating. For this reason, inverter output halts when the supply voltage falls to 150V or below (300V or below in the case of 400 V class units). (2) The undervoltage protection function operates if there is no short bar between P and P1.		E.UVT	●	
Fin overheat		If the cooling fin overheats, the fin overheat sensor activates and halts inverter output.		E.FIN	●	
Fan trouble		In the case of inverters with built-in cooling fans, "FN" is displayed at the control panel if the cooling fan stops operation because of trouble, or operates differently from the setting for Pr. 244 (Cooling fan operation selection). Inverter output does not halt.		FN		●
Brake resistor overheating protection		Inverters with a capacity of 7.5K or less are equipped with a built-in brake resistor. When the regenerative energy from the motor exceeds the prescribed value, brake circuit operations halt temporarily to protect the brake resistor from overheating. (Performing braking operations in this state causes a regenerative overvoltage cut-off.) After the time required to cool the brake resistor has passed, brake circuit operations restart.		–		
Brake transistor error detection		Inverter output halts when the brake transistor is damaged or other faults occur in the brake circuit. In such cases, it is necessary to shut off the inverter's power supply immediately.		E.BE	●	
Output side ground fault overcurrent protection		Inverter output halts when a ground fault occurs on the inverter's output side (load side) and a ground fault overcurrent is generated.		E.GF	●	
External thermal relay operation (Note 1)		When an externally installed motor overheating protective thermal relay or temperature relay within the motor, etc., activates (relay contact open), the inverter can be stopped if the contact is input to the inverter. Even if the relay contact resets automatically, the inverter will not restart unless it is reset also.		E.OHT	●	
Option error		(1) When a dedicated built-in type option is installed within the inverter, inverter output halts if there is a setting error or the connection is faulty. (2) When a high-power factor converter connection is set, the display indicates that an AC power supply is connected to R, S, T.		E.OPT	●	
Parameter error		Generated when an error occurs in a stored parameter (e.g. E^2ROM breakdown).		E.PE	●	
PU disconnected		Inverter output halts when communication between the main unit and the PU are interrupted by disconnection of the PU, etc., when Pr. 75 is set to 2,3, 16, 17.		E.PUE	●	
No. of retries exceeded		When operations cannot be restarted normally within the set number of retries, inverter output is halted.		E.RET	●	
Output phase loss detection		Detects when the inverter looses an output phase (U, V or W).		E.LF	●	
CPU error		If the built-in CPU does not complete operations within the prescribed time, it self-diagnoses a fault and halts inverter output.		E.CPU	●	
Current limit/ Stall prevention	During acceleration	When a current of 150% (Note 2) or more of the inverter's rated current flows in the motor, the rise in frequency is stopped until the load current declines, preventing the inverter from executing an over-current shut-off. The frequency is increased again once the current falls below 150% of the rated value.		OL	●	
	At constant speed	When a current of 150% (Note 2) or more of the inverter's rated current flows in the motor, the frequency is lowered until the load current declines, preventing the inverter from executing an over-current shut-off. The frequency is restored to the set level once the current falls below 150% of the rated value.		E.OLT (when inverter output is halted)		
	During deceleration	If the motor's regenerative energy is excessive and surpasses its braking capacity, the decline in frequency is halted, preventing the inverter from executing an over-current shut-off. Once the regenerative energy has declined, deceleration continues. When a current of 150% (Note 2) or more of the inverter's rated current flows in the motor, the decline in frequency is halted until the load current declines, preventing the inverter from executing an over-current shut-off. The frequency is lowered once again once the current falls below 150% of the rated value.				
24VDC power supply output short circuit		When the 24VDC power output from the PC terminal is short circuited, power output is shut off. At such times, all external contact inputs are switched OFF. Resetting cannot be performed by an RES signal input. To reset, either use the control panel or shut off the power, then turn it on again.		E.P24		
Operating panel power supply short circuit		When the control panel power supply (P5S of the PU connector) is short circuited, power output is shut off. At such times, it is not possible to use the control panel (parameter unit) or perform RS-485 communications from the PU connector. To reset, either input an RES signal or shut off the power, then turn it on again.		E.CTE		
Brake sequence error		In the case where a sequence error occurs when using the brake sequence functions (Pr. 278~Pr. 285), inverter output is halted. Please consult the manual for details about errors.		E.MB1~MB7		

Notes:
1. External thermal relay operations are only performed when Pr. 180~Pr. 186 (input terminal function selection) is set to OH.
2. Indicated when the stall prevention operation current level is set to 150% (default setting). When this value is altered, stall prevention is performed at the altered set value.
3. Major faults: The protective function activates, inverter output is shut off, and an error out is executed. Minor faults: Output is not shut off even when the protective function activates. It is possible to output minor fault signals by setting parameters.
4. In the case where Pr. 190~Pr. 196 (output terminal function selection) are set to the default values.

● Resetting Methods

When a protective function is activated, it halts inverter output (the motor coasts to a halt). It is held in this state and will not restart unless it is reset. To reset the inverter, three methods are available:
- shut off the power, then turn it on again;
- switch the reset (RES) signal ON for at least 0.1 second, then OFF;
- press the RESET key on the control panel or parameter unit. (Use the parameter unit's help function)

If the RES signal is ON continuously, the control panel indicates "Err" while the parameter unit indicates that it is in the process of resetting.

Notes:
1. Displays
   When the protective circuit is activated, the LED display on the control panel automatically changes according to the indications in the above table. In the case of the parameter unit, the unit's liquid crystal display gives a more detailed explanation of the fault.
2. Holding the error output signal
   When protective functions operate, if the electromagnetic contactor installed on the inverter's power supply side is switched OFF, the inverter's control source disappears and it becomes impossible to hold the error output signal. If it is necessary to hold the signal, make the error output a sequence that is held externally.
   If the control circuit is provided with a separate power supply as described below, it is possible to hold the error signal and error display. Details of the fault are stored even if the power supply is shut off, and can be confirmed at the control panel (parameter unit).

■ Connecting the control circuit to a separate power supply

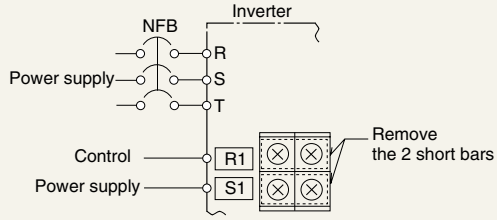
● In the case of FR-A520-0.4K~3.7K/FR-A540-0.4K~3.7K

Remove the short bar between terminals R-R1 and S-S1, and connect the control source to terminals R1, S1.

● In the case of FR-A520-5.5K~55K/FR-A540-5.5K~55K

As shown in the diagram, remove the short bars from the two-tier terminal block (see inverter manual for further details), and connect the control source to the upper-tier terminal.

Note: Connecting the control source to the lower-tier terminal will damage the inverter.

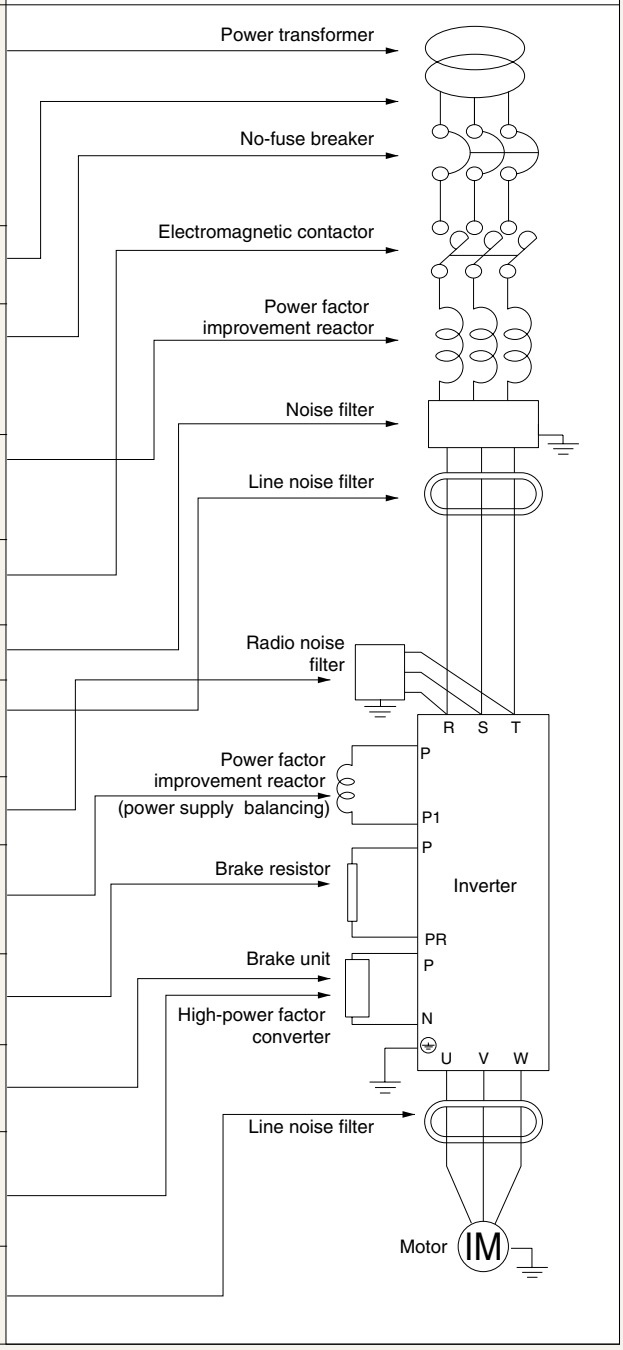


Notes:
1. The control source (R1, S1) does not need to be phase sequenced with the main power supply (R, S, T). However, the phase sequence must be matched when the optional FR-HC high-power factor converter is used.
2. Even if the main power supply is OFF, the error output will not function.
3. The inverter can be reset by turning the main power supply OFF, the ON again.
4. Do not turn the control source OFF when the main power supply is ON.
5. When using the FR-BIF radio noise filter (sold separately), connect it to the primary side of the MC. If it is connected to the secondary side, the insufficient voltage alarm (E.UVT) will be triggered when the MC is turned off.

Selecting Peripherals and Options

Name (Model)	Functions & Applications, etc.
Power facility capacity	Please select a power supply that is larger than the kVA values stated in the "Power facility capacity" column in the Ratings table (p.8). However, in the case where the value exceeds 1000kVA and the wiring length is 10m or less, install an FR-BEL DC reactor (or AC reactor) to balance the power supply. It should also be installed to prevent erroneous operation of the inverter in the case where surge voltages occur in the power supply line because thyristor converters, vacuum contactors, etc., exist on the same power supply system. In addition, it is effective in improving the inverter's power factor. Finally, it should also be installed when the imbalance in the supply voltage is 3% or more.
Input side main circuit wire	On the inverter's input side, current flow is larger than in the case where the motor is operated using a commercial power supply.
No-fuse breaker or earth leakage breaker	A large inrush current flows when the inverter's power is turned on, it is necessary to be careful when selecting a no-fuse breaker. When selecting an earth leakage breaker, please select a model such as Mitsubishi's New Super NV which has been designed to cope with the high frequency components generated by the inverter, and can cope with high frequencies and surges.
Power factor improvement AC reactor(FR-BAL)	All models in the FR-A500 series from 0.4kW~55kW (200V,400V) are equipped with a terminal for connecting the FR-BEL DC reactor. The FR-BEL is a compact, lightweight DC reactor which delivers greater efficiency in input power factor improvement and power supply balancing, and its use is highly recommended.
Electromagnetic contactor	It is necessary to be careful when selecting an electromagnetic contactor for the same reason as in the case of selecting a no-fuse breaker.
Noise filter (SF)	For reducing the electromagnetic noise generated by the inverter. Complies with EC noise directives. A dedicated filter for the input side.
Line noise filter (FR-BSF01)(FR-BLF)	For reducing the electromagnetic noise generated by the inverter. Generally speaking, effective in the frequency band from 1MHz to 10MHz. The greater the number of wire feed-throughs, the more effective the filter is.
Radio noise filter (FR-BIF)	For reducing the electromagnetic noise in the AM radio frequency band generated by the inverter. A dedicated filter for the input side.
Power factor improvement and power supply balancing DC reactor (FR-BEL)	For use in inverter input power factor improvement. Effective in reducing input harmonics. Also useful when power supply balancing is necessary.
Brake resistor for frequent braking operations (FR-ABR)	Useful in applications that involve frequent stopping or large moments of inertia (GD^2) and in cases where it is necessary to boost the braking capacity (%ED) of the inverter's built-in brake resistor (7.5K and below).
FR-BU brake units and FR-BR resistor units	Brake units for use in boosting the inverter's braking capacity. Provide powerful braking performance in a wide range of applicable units, from small to large capacity. Used in combination with resistor units.
High-power factor converter (FR-HC)	For use in suppressing the input harmonics. Under the "Japanese Harmonics Suppression Countermeasure Guidelines for Specific Customers," the equivalent capacity conversion coefficient is K5=0. Since it is equipped with a power regeneration function, it is also ideal for applications where large braking capacity is required.
Line noise filter (FR-BSF01)(FR-BLF)	For use in reducing line noise at the inverter's output side. Can be installed at both the input and the output side. In the case where it is installed at the output side, the number of wire feed-throughs should be less than 4 turns (4T).

Installation location



List of Options

	Name	Type	Application, specifications, etc.	Applicable inverter
Built-in options (FR-A500 only)	12-bit digital input	FR-A5AX	A digital signal of BCD or binary code used for setting the inverter's frequency.	Common to all units
	Digital output	FR-A5AY	Outputs the inverter main unit's standard output signal at the open collector.	
	Expansion analog output		Outputs signals such as output frequency, output voltage, output current in analog form.	
	Relay output	FR-A5AR	Outputs the inverter main unit's standard output signal at the relay contact.	
	Orientation control, PLG feedback control	FR-A5AP	In combination with a pulse encoder, can halt the main axis at the home position (orientation). Provides feedback of the motor's rotational speed and keeps speed constant.	Common to all units (Available soon)
	Pulse train input		Can input speed instructions to the inverter as pulse train signals.	
	Computer link	FR-A5NR	Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	
	Profibus DP	FR-A5NP	Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	
	DeviceNetTM	FR-A5ND	Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	
	CC-Link	FR-A5NC	Allows changes in inverter operations, monitoring and parameters to be executed from a PLC.	
	Modbus Plus	FR-A5NM	Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	
Standalone, common	Parameter unit (8 languages)	FR-PU04	Interactive parameter unit with LCD	Common to all units
	Parameter unit connector cable	FR-CB2 ☐ ☐	Cable for connecting control panel or parameter unit	
	Cooling fan external installation attachment	FR-A5CN ☐ ☐	Allows inverter's heat generating parts to be installed externally at the back of the unit.	For inverter capacities 1.5K~55K
	IP40 attachment	FR-A5CV ☐ ☐	Allows inverter's to meet IP40 specifications	For inverter capacities 0.4K~22K
	Conduit connection attachment	FR-A5FN ☐ ☐	Allows direct connection of conduits. IP20 compliance possible.	For inverter capacities 30K~55K
	Mounting adaptor attachment	FR-A5AT ☐ ☐	Plate to allow mounting using same dimensions as FR-A200E models.	For inverter capacities 0.4K~22K, 55K
	Noise filter (compliant with EMC Directives)	SF ☐ ☐	Noise filter (compliant with EMC Directives) (EN61800-3, EN50081-2)	For inverter capacities 0.4K~55K
	Brake resistor for frequent braking operations	FR-ABR-(H) ☐ ☐ (Note 1)	Boosts braking capacity of inverter's built-in brake	For inverter capacities 0.4K~7.5K
	Surge voltage suppression filter	FR-ASF-H ☐ ☐	Filter for suppressing micro-surge voltage at inverter's output side	For inverter capacities 0.4K~55K
	Power factor improvement DC reactor	FR-BEL(H) ☐ ☐ (Note 1)	For inverter input power factor improvement (overall power factor approx. 95%) and power supply balancing	For inverter capacities 0.4K~55K
	Power factor improvement AC reactor	FR-BAL-(H) ☐ ☐ (Note 1)	For inverter input power factor improvement (overall power factor approx. 90%) and power supply balancing	For inverter capacities 0.4K~55K
	Radio noise filter	FR-BIF-(H) ☐ ☐ (Note 1)	For suppressing radio noise	Common to all units
	Line noise filter	FR-BSF01	For suppressing line noise (for small capacities of 3.7kW or less)	
		FR-BLF	For suppressing line noise	
	Brake unit Resistor unit	FR-BU-15K~55K, H15K~H55K FR-BR-15K~55K, H15K~H55K	For use in boosting inverter's braking capacity. (For high inertia loads or negative loads.) Used in combination with resistor units.	Depends on capacity
	Power regeneration converter	FR-RC-15K~55K,H15K~H55K	High performance brake unit capable of regenerating braking energy generated by motor.	
	High-power factor converter	FR-HC7.5K~55K, H7.5K~H55K	Greatly suppresses high frequencies by improving input current waveforms into sine waves by switching converter.(Used in conjunction with standard accessories) Power regeneration also possible.	

Note: Units in the 400V class are designed by an "H" in the model name.

List of Options

Built-in Options

Name		Model	Function	Rating, etc.
12-bit digital input		FR-A5AX	● Input interface for precise setting of the inverter's frequency using external 3-digit digital signals of BCD or binary code. ● Can also execute gain/offset adjustments.	● Input voltage: 24VDC 5mA (per circuit) ● Signal format: contact signal or open collector input ● Logic: sink type or source type (switchover possible at main unit)
Digital output		FR-A5AY	● Selects any 7 signals from the 26 output signal types provided in the inverter main unit as standard and outputs them at the open collector.	● Permissible load: 24VDC 0.1A (per circuit) ● Logic: sink type or source type (common)
Expansion analog output			● Outputs any 2 signals form the 16 types of signals, such as output frequency, output voltage, output current, that can be monitored at the FM or AM terminal. ● A 20mA DC or 5VDC (10V) meter can be connected.	● Output voltage: 0~10VDC max. ● Output current: 0~20mA DC ● Output resolution: 3mV at voltage output, 1μA at current output ● Output precision: ±10%
Relay output		FR-A5AR	● Selects any 3 signals from the 26 output signal types provided in the inverter main unit as standard and outputs them at the relay contact.	● Signal type: Contactor ● Contact capacity: 230VAC 0.3A 30VDC 0.3A
Orientation control, PLG feedback control		FR-A5AP	● In combination with a position detector (pulse encoder) attached to the main axis of a machine tool, can halt the main axis at the home position (orientation function). ● The pulse encoder detects the motor's rotational speed and the detected signal is fed back to the inverter, automatically correcting for speed variations. As a result, the motor speed is kept constant even if load variations occur. ● The current position of the main axis and the motor's actual rotational speed can be monitored using the control panel or the parameter unit.	● Motor used: Standard motor (2-8 poles) ● Encoder specification: Differential output, 5V DC
Pulse train input			● Input speed to the inverter as pulse train signals.	● Max. permissible number of pulses: 100K pps or less ● Input interface: Open collector ● Input voltage/current: 24V, 10mA DC
Communications	Computer link	FR-A5NR	● Connects the inverter with a personal computer, FA controller or other computer using a communications cable, and allows changes in inverter operation, monitoring and parameter changing to be executed from the computer by means of user programs. ● Use of twisted pair cable protects communications against noise.	● Compliance standards: EIA RS485, RS422 standards (common) ● Transmission format: multi-drop link ● Communication rate: 19,200 baud max. ● Up to 32 units can be connected ● Total length: 500m
	Profibus DP	FR-A5NP	● Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	● Up to 42 units can be connected
	DeviceNet™	FR-A5ND	● Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	● Communication rate: 10M baud max.
	CC-Link	FR-A5NC	● Allows changes in inverter operations, monitoring and parameters to be executed from a PLC.	● Total length: 1200m (at 156K baud)
	Modbus Plus	FR-A5NM	● Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	● Total length: 100m (at 10M baud)

Note: 3 option cards can be mounted at one time, limited to one card of each option type. Only one communications card can be mounted.

List of Options

Standalone Options

FR-A5CN □□
Attachment for external mounting of cooling fin

- By using this attachment, the cooling fin, which is the inverter's heat-generating component, can be extended to the back of the housing plate. This makes it possible to radiate the inverter's heat to the back of the housing plate, allowing the control panel to be made more compact.
- Use of this attachment increases the mounting space by the size of the attachment. Therefore, when using this attachment, refer to the dimensions (page 12) that include the attachment.
- Refer to page 12 for the dimensions of the panel cut.

Model	Applicable inverter	
	200V class	400V class
FR-A5CN01	FR-A520-1.5K~3.7K	FR-A540-0.4K~3.7K
FR-A5CN02	FR-A520-5.5K/7.5K	FR-A540-5.5K/7.5K
FR-A5CN03	FR-A520-11K	—
FR-A5CN04	FR-A520-15K~22K	FR-A540-11K~22KK

FR-A5CV □□
Attachment for IP40

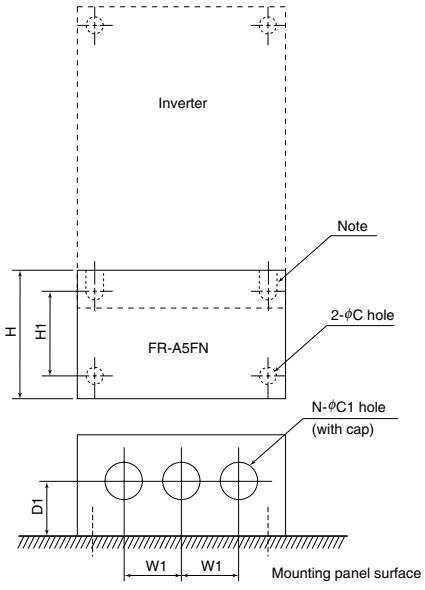
- The inverter can be converted to IP40 specification by mounting this attachment on the inverter's top/bottom or left/right slits.
- This attachment is suited for wall mounting.
  (The IP40 [JEM1030]: The attachment is constructed so that wires larger than 1 mm in diameter or drive belts thicker than 1 mm do not project into the inverter.)

Notes
1: This attachment is not constructed to be impervious to water or other liquids, and therefore is not suited to environments with lots of dripping water, soot etc.
2: When using this attachment, the inverter's allowable ambient temperature is –10° to 40°C.

Model	Applicable inverter	
	200V class	400V class
FR-A5CV01	FR-A520-0.4K~7.5K	FR-A540-0.4K~7.5K
FR-A5CV02	FR-A520-11K~22K	FR-A540-11K~22K

FR-A5FN □□
Attachment for conduit connection

- This attachment is for connecting a conduit directly to the inverter. It is mounted on the bottom of the inverter.
- 30K~55K (200 V~400 V) inverters can be brought up to IP20 specifications by mounting this attachment. (Standard is IP00)



Note: Attachment is fastened in four places, with two mounting screws on the bottom of the inverter and at two places on the bottom of the FR-A5FN.

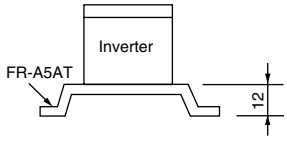
Model	Applicable inverter	
	200V class	400V class
FR-A5FN01	FR-A520-30K	FR-A540-30K
FR-A5FN02	FR-A520-37K/45K	FR-A540-37K/55K
FR-A5FN03	FR-A520-55K	—

• Attachment Dimensions (unit: mm)

Model	H	W1	H1	D1	N	C	C1
FR-A5FN01	157.5	95	102.5	125	3	10	76
FR-A5FN02	297.5	113	227.5	120	3	12	91
FR-A5FN03	297.5	113	227.5	120	4	12	91

Mounting adapter attachment FR-A5AT□□

This attachment allows FR-A500 series models to be mounted using the same holes as those used for FR-A200E series models, greatly facilitating the task of replacing earlier models.
11K~15K, 30K~55K models in the 200V class, and 11K~15K models in the 400V do not require the adapter because they use the same mounting dimension as earlier models.
Note: When the adapter is used, the installation dimensions change as a result of an increase in depth.



Model	Applicable inverter	
	200V class	400V class
FR-A5AT01	FR-A520-0.4K/0.75K	—
FR-A5AT02	FR-A520-1.5K~3.7K	FR-A540-0.4K~3.7K
FR-A5AT03	FR-A520-5.5K/7.5K	FR-A540-5.5K/7.5K
FR-A5AT04	FR-A520-18.5K/22K	FR-A540-18.5K/22K
FR-A5AT05	—	FR-A540-55K

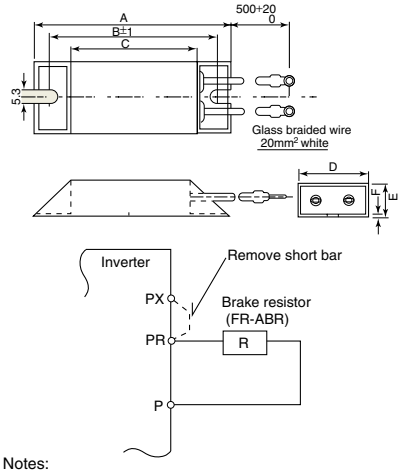
List of Options

Brake resistor for frequent braking operations FR-ABR-(H)☐☐K

External Dimensions (Units: mm)

	Brake resister model	Permissible brake duty	External dimensions A	B	C	D	E	F	Resistance value (Ω)	Approximate weight (kg)
200V class	FR-ABR-0.4K	10%	140	125	100	40	20	2.5	200	0.2
	FR-ABR-0.75K	10%	215	200	175	40	20	2.5	100	0.4
	FR-ABR-2.2K (Note)	10%	240	225	200	50	25	2.0	60	0.5
	FR-ABR-3.7K	10%	215	200	175	60	30	2.5	40	0.8
	FR-ABR-5.5K	10%	335	320	295	60	30	2.5	25	1.3
	FR-ABR-7.5K	10%	400	385	360	80	40	2.5	20	2.2
400V class	FR-ABR-H0.4K	10%	115	100	75	40	20	2.5	1200	0.2
	FR-ABR-H0.75K	10%	140	125	100	40	20	2.5	700	0.2
	FR-ABR-H1.5K	10%	215	200	175	40	20	2.5	350	0.4
	FR-ABR-H2.2K	10%	240	225	200	50	25	2.0	250	0.5
	FR-ABR-H3.7K	10%	215	200	175	60	30	2.5	150	0.8
	FR-ABR-H5.5K	10%	335	320	295	60	30	2.5	110	1.3
	FR-ABR-H7.5K	10%	400	385	360	80	40	2.5	75	2.2

Note: 1.5K, 2.2K common



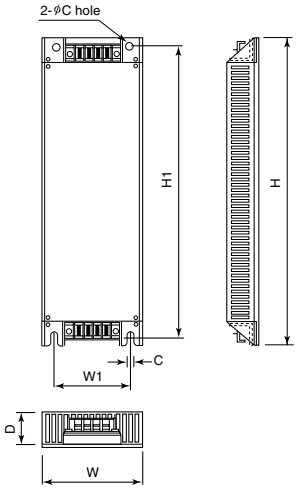
Notes:
1. When using the FR-ABR brake resistor, remove the short bar between terminals PR and PX. Leaving the short bar in place will cause the built-in brake resister to overheat. (There is no need to remove the built-in brake resistor.)
2. Regenerative brake duty should be set at levels below the permissible brake duty levels stated in the table.
3. Since the temperature of the brake resistor may exceed 300C°, depending on how frequently it operates, please take care with installation and heat dissipation.
4. MYS type resistors may also be used, but care should be taken with permissible brake duty.

Noise filter (compliant with EMC Directives) SF☐☐

Compliant with European EMC Directives

External dimensions

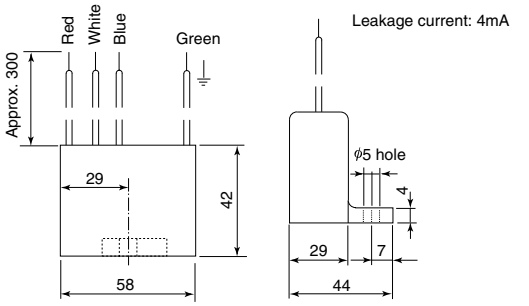
	Noise filter model	Applicable inverter model	Noise filter external dimensions (unit: mm) W	H	D	W1	H1	C	Approximate weight (kg)	Loss (W)	Leakage current reference value (mA)
200V	SF1258	FR-A520-0.4K/0.75K	112	360	40	85	340	6	1	8	22
	SF1259	FR-A520-1.5K~3.7K	142	410	65	105	386	6	2.4	27	33
	SF1260	FR-A520-5.5K~11K	222	468	80	190	449	7	5	118	440
	SF1261	FR-A520-15K	253	600	86	220	575	10	7.6	37	71
	SF1262	FR-A520-18.5K/22K	303	650	86	270	625	10	8.6	57	71
	SF1263	FR-A520-30K	327	730	86	293	705	10	11	100	71
	SF1265	FR-A520-37K~55K	468	913	110	410	768	12	22	52	1500
400V	SF1197	FR-A540-0.4K~3.7K	114	360	47.5	117	340	6	1.5	10	57
	SF1147B	FR-A540-5.5K/7.5K	213	360	38	180	340	6	1.8	51	51
	SF1175	FR-A540-11K/15K	253	530	60	220	505	10	4.7	56	76
	SF1176	FR-A540-18.5K/22K	303	600	60	260	575	10	5.9	71	108
	SF1177	FR-A540-30K	327	700	80	280	675	10	9.4	65	156
	SF1178	FR-A540-37K/45K	450	770	80	384	735	12	16	74	156
	SF1179	FR-A540-55K	467	920	80	410	895	12	125	125	156

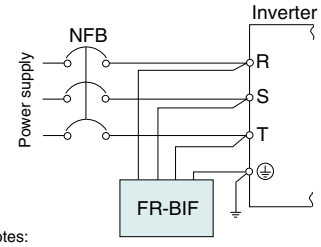


Note:
With some exceptions, the mounting adapter attachment (FR-A5AT☐☐) is necessary.
When the adapter is used, the installation dimensions change as a result of an increase in depth.

Measures to deal with leakage current
Please take the following steps to prevent erroneous operation of peripherals and electric shocks caused by leakage current:
1. Ground the noise filter before connecting to the power supply. In this case, please confirm that it is properly grounded to earth via the panel's ground.
2. Please note, the noise filter's leakage current when selecting earth leakage breakers or earth leakage relays. Also, in cases where earth leakage breakers or earth leakage relays cannot be used because the leakage current of a large-capacity noise filter is too large, ensure that the grounding measures referred to in 1. are properly taken.

Radio noise filter FR-BIF.....- 200V class FR-BIF-H.....- 400V class



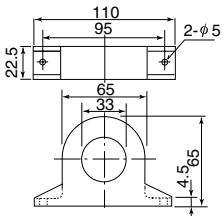


Notes:
1. Cannot be connected to inverter's output side.
2. Cut wiring as short as possible and connect with inverter's terminal block

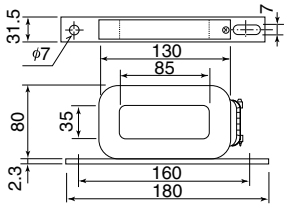
List of Options

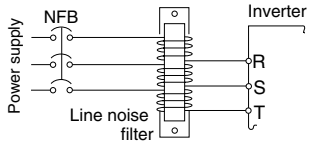
Line noise filter FR-BSF01 (for small capacities) FR-BLF

FR-BSF01



FR-BLF



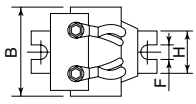


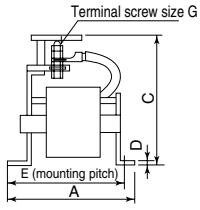
Notes:
1. Each phase should be wound at least 3 times (4T, 4 turns) in the same direction. (The greater the number of turns, the more efficient.)
2. When the thickness of the wire prevents winding, use at least 4 in series and ensure that the current passes through each phase in the same direction.
3. Can be used on the output side in the same way as the input side. On the output side, the number of turns should be less than 3 (4T, 4 turns).
4. Please use FR-BSF01 for inverters with small capacities of 3.7kW or less. Thick wires (38mm² or more) cannot be used. In such cases, use FR-BLF.

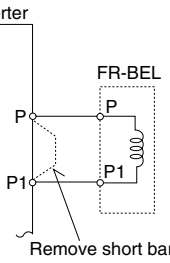
Power factor improvement DC reactor (for power supply balancing) FR-BEL(H) ☐☐K

Input power factor: approx. 95%

	Model	A	B	C	D	E	F	G	H	Weight (kg)
200V	0.4K	110	50	94	1.6	95	6	M3.5	25	0.5
	0.75K	120	53	102	1.6	105	6	M4	25	0.7
	1.5K	130	65	110	1.6	115	6	M4	30	1.1
	2.2K	130	65	110	1.6	115	6	M4	30	1.2
	3.7K	150	75	102	2	135	6	M4	40	1.7
	5.5K	150	75	126	2	135	6	M5	40	2.2
	7.5K	150	75	126	2	135	6	M5	40	2.3
	11K	170	93	132	2.3	155	6	M5	50	3.1
	15K	170	93	170	2.3	155	6	M8	56	3.8
	18.5K	185	94	184	2.6	165	7	M8	56	5.1
	22K	185	119	182	2.6	165	7	M8	70	5.4
	30K	185	119	201	2.6	165	7	M8	70	6.7
	37K	195	136	215	2.6	175	7	M10	70	7.4
	45K	195	136	215	2.6	175	7	M10	70	8.0
	55K	195	136	246	3.2	175	9	M12	80	9.8
400V	H0.4K	100	54	80	1.6	85	6	M3.5	28	0.5
	H0.75K	110	54	85	1.6	95	6	M3.5	28	0.7
	H1.5K	130	63	89	1.6	115	6	M3.5	32	0.9
	H2.2K	130	63	101	1.6	115	6	M3.5	32	1.1
	H3.7K	150	75	102	2	135	6	M4	40	1.7
	H5.5K	150	75	124	2	135	6	M4	40	2.2
	H7.5K	150	75	124	2	135	6	M4	40	2.3
	H11K	170	93	132	2.3	155	6	M5	50	3.1
	H15K	170	93	160	2.3	155	6	M6	56	3.7
	H18.5K	185	94	173	2.6	165	7	M6	56	4.8
	H22K	185	119	171	2.6	165	7	M6	70	5.0
	H30K	185	119	189	2.6	165	7	M6	70	6.7
	H37K	195	136	199	2.6	175	7	M8	70	7.0
	H45K	195	138	219	3.2	175	9	M8	80	8.6
	H55K	195	138	219	3.2	175	9	M8	80	9.0





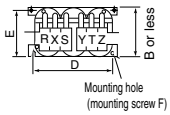


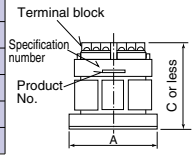
Notes:
1. Be sure to remove the short bar between inverter terminals P and P1 (unless the short bar is removed, there is no power factor improvement).
2. The wiring distance between the inverter and the reactor should be less than 5m.
3. The size of the wire used should be the same or greater than the power supply wire (R,S,T).
4. Select according to motor capacity. (Where the capacity of the inverter is greater than that of the motor, match the capacity with that of the motor.)

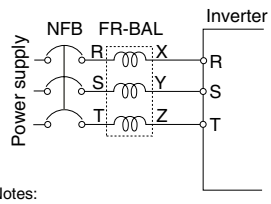
Power factor improvement AC reactor (for power supply balancing) FR-BAL(H) ☐☐K

Input power factor: approx. 90%

Motor capacity	FR-BAL A	B	C	D	E	F	Weight (kg)	FR-BAL-H A	B	C	D	E	F	Weight (kg)
0.4kW	135	64	120	120	45	M4	2	135	64	120	120	45	M4	2.1
0.75kW	135	74	120	120	57	M4	3	160	76	145	145	55	M4	3.7
1.5kW	160	76	145	145	55	M4	4	160	92	145	145	70	M4	5.3
2.2kW	160	96	145	145	75	M4	6	160	96	145	145	75	M4	5.9
3.7kW	220	95	200	200	70	M5	8.5	220	95	195	200	70	M5	8.5
5.5kW	220	101	200	200	75	M5	9.5	220	101	200	200	75	M5	9.5
7.5kW	220	125	205	200	100	M5	14.5	220	125	200	200	100	M5	14
11kW	280	140	245	255	100	M6	19	280	140	235	255	100	M6	18.5
15kW	295	156	280	270	110	M6	27	295	156	270	270	110	M8	27
22kW	290	200	300	240	170	M8	35	290	200	300	240	170	M8	35
30kW	290	220	300	240	190	M8	43	290	220	300	240	190	M8	43
37kW	330	240	310	270	190	M10	50	330	220	360	270	190	M10	50
45kW	330	240	360	270	190	M10	60	330	220	410	270	190	M10	60
55kW	330	245	400	270	190	M10	70	330	220	450	270	190	M10	70







Notes:
1. The input power factor is improved to approximately 90%.
2. Select according to applicable motor capacity. (Where the capacity of the motor is greater than that of the inverter, match the capacity with that of the motor.)
3. When the motor capacity is 18.5kW, select the model for 22kW. Install the FR-BAL power factor improvement AC reactor when using a power regeneration converter.

FR-BU Brake Units/FR-BR Resistor Units

- Brake units and resistor units are options that fully enhance the regenerative braking capability of the inverter, and should be used together.
- There are 6 types of brake unit as shown in the table below. They should be selected according to the required braking torque and deceleration time using the selection table.
- Brake units are equipped with a 7-segment LED which displays duty (%ED) and errors.

Brake Unit Selection Table

- Short-time rated %ED at 100% braking torque

Motor capacity				5.5kW	7.5kW	11kW	15kW	18.5k	22kW	30kW	37kW	45kW	55kW
Inverter			200V	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
			400V	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Brake unit	200V	FR-BU-15K	%ED	80	40	15	10	–	–	–	–	–	–
		FR-BU-30K		–	–	65	30	25	15	10	–	–	–
		FR-BU-55K		–	–	–	–	90	60	30	20	15	10
	400V	FR-BU-H15K	%ED	80	40	15	10	–	–	–	–	–	–
		FR-BU-H30K		–	–	65	30	25	15	10	–	–	–
		FR-BU-H55K		–	–	–	–	90	60	30	20	15	10

- Short-time rated braking torque (%) at 10% ED 15 seconds

Motor capacity				5.5kW	7.5kW	11kW	15kW	18.5kW	22kW	30kW	37kW	45kW	55kW
Inverter			200V	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
			400V	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Brake unit	200V	FR-BU-15K	Braking torque (%)	280	200	120	100	80	70	—	—	—	—
		FR-BU-30K		—	—	260	180	160	130	100	80	70	—
		FR-BU-55K		—	—	—	—	300	250	180	150	120	100
	400V	FR-BU-H15K	Braking torque (%)	280	200	120	100	80	70	—	—	—	—
		FR-BU-H30K		—	—	260	180	160	130	100	80	70	—
		FR-BU-H55K		—	—	—	—	300	250	180	150	120	100

Resistor unit Brake unit

Brake Unit/Resistor Unit Combinations and Wiring

Brake unit model		Resistor unit model	Wiring (P-P/+,N-N/-, P/+-P,PR-PR)
200V	FR-BU-15K FR-BU-30K FR-BU-55K	FR-BR-15K FR-BR-30K FR-BR-55K	3.5mm² (AWG12) 5.5mm² (AWG10) 14mm² (AWG6)
400V	FR-BU-H15K FR-BU-H30K FR-BU-H55K	FR-BR-H15K FR-BR-H30K FR-BR-H55K	3.5mm² (AWG12) 3.5mm² (AWG12) 5.5mm² (AWG10)

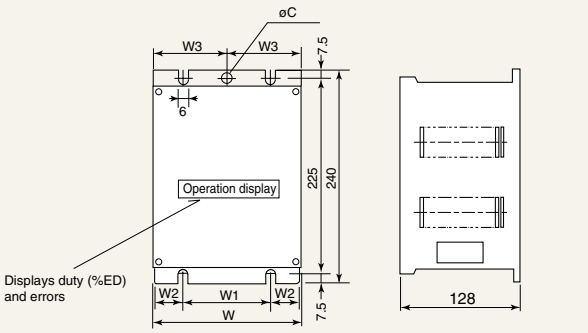
Use the above recommended wiring sizes or larger sizes.

Notes:
1. Since the temperature of the resistor unit increases up to a maximum of 100°C, use heat-resistant wiring (glass braided wire, etc.) or encase the wire in silicon tubing.
2. Please be sure to connect the terminals P/+ and N/- correctly with the inverter's P and N terminals. The brake unit will not function properly if the connections are incorrect.

External Dimensions

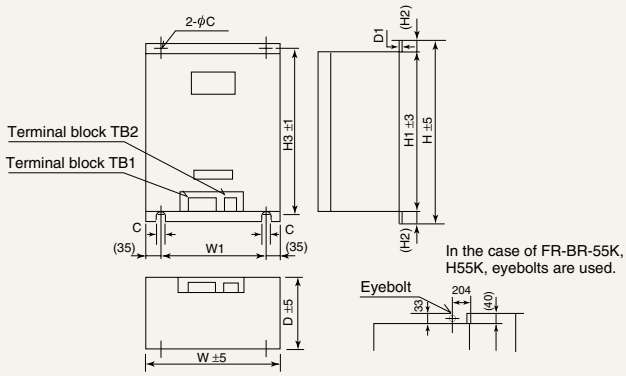
● Brake unit

(unit: mm)



● Resistor unit

(unit: mm)

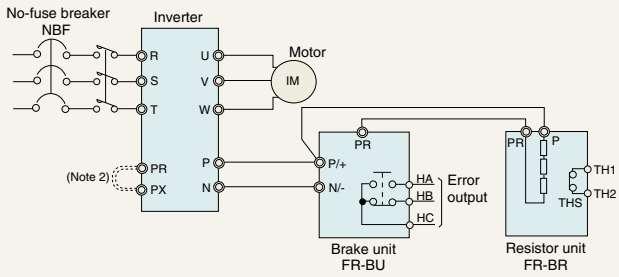


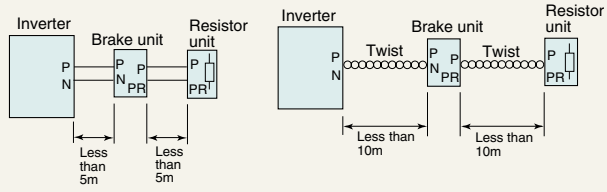
Brake unit model		W	W1	W2	W3	C	Approximate weight (kg)
200V	FR-BU-15K	100	60	18.5	48.5	6	2.4
	FR-BU-30K	160	90	33.5	78.5	6	3.2
	FR-BU-55K	265	145	58.5	—	—	5.8
400V	FR-BU-H15K	160	90	33.5	78.5	6	3.2
	FR-BU-H30K	160	90	33.5	78.5	6	3.2
	FR-BU-H55K	265	145	58.5	—	—	5.8

Resistor unit model		W	H	H1	H2	D	D1	W1	H3	C	Approximate weight (kg)
200V	FR-BR-15K	170	450	410	20	220	3.2	100	432	6	15
	FR-BR-30K	340	600	560	20	220	4	270	582	10	30
	FR-BR-55K Note	480	700	620	40	450	3.2	410	670	12	70
400V	FR-BR-H15K	170	450	410	20	220	3.2	100	432	6	15
	FR-BR-H30K	340	600	560	20	220	4	270	582	10	30
	FR-BR-H55K Note	480	700	620	40	450	3.2	410	670	12	70

Note: Eyebolts are used in two places.

Example of External Connection





Notes:
1. The wiring between the inverter and the brake unit, and the resistor unit and the brake unit, should be kept as short as possible. If it exceeds 5 meters, use twisted wire. (When twisted wire is used, the distance should not exceed 10 meters.) Select a wiring size larger than the recommended size.
2. When using FR-BU with an inverter with a capacity of 7.5K or below, the short bar between terminals PR and PX must be removed.

FR-HC High-power Factor Converters
FR-RC Power Regenerating Converters

FR-HC High-power Factor Converters

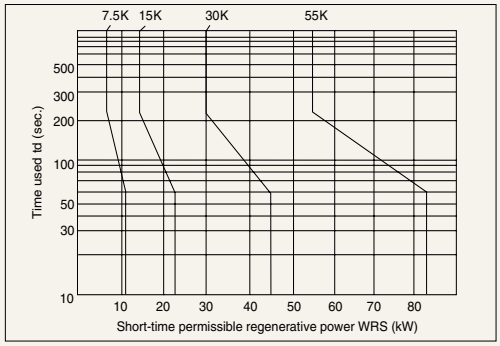
- Used for suppressing the high frequencies of the inverter's power supply, it achieves an equivalent capacity conversion coefficient of K5=0 under the "Japanese Harmonics Suppression Countermeasure Guidelines for Specific Customers."
- Improves input current waves into sine waves.
- Reduces input capacity by improving input power factor.
- Power source regenerative functions included as standard.
- Integrated converter operation with multiple connection to inverters possible.

Specifications

ModelFR-HC- □□		200V				400V			
		7.5K	15K	30K	55K	H7.5K	H15K	H30K	H55K
Applicable inverter capacity (Note 1)		3.7K~7.5K	7.5K~15K	15K~30K	30K~55K	3.7K~7.5K	7.5K~15K	15K~30K	30K~55K
Rated input voltage/frequency		3-phase 200V~220V50Hz 200V~230V 60Hz				3-phase 380V~460V 50/60Hz			
Rated input current		33	61	115	215	17	31	57	110
Rated output voltage (V) (Note 2)		DC293V~335V				DC558V~670V			
Approxi-mate weight (kg)	Unit (kg)	8	15	29	70	9	16	35	72
	Accessory components (reactors 1,2, external box) total (kg)	21	31	67	97	23	32	52	94

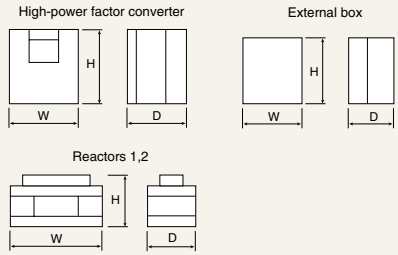
Notes:
1. With regard to the applicable inverter for the high-power factor converter, the applicable capacity is the total capacity.
2. The output voltage changes according to the input voltage value.

Regenerative Power Capacity



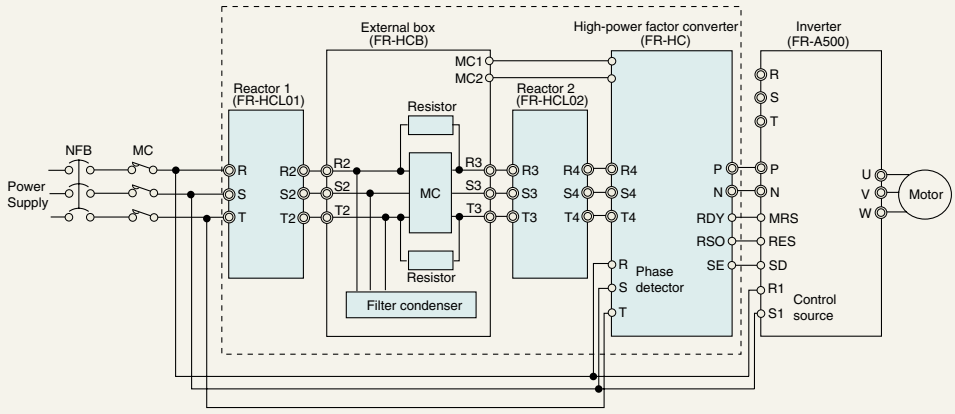
External Dimensions

Voltage	Capacity	FR-HC converter			Reactor 1 FR-HCL01			Reactor 2 FR-HCL02			External box FR-HCB		
		W	H	D	W	H	D	W	H	D	W	H	D
200V	7.5K	220	300	190	160	155	100	240	230	160	190	320	165
	15K	250	400	190	190	205	130	260	270	170			
	30K	340	550	195	200	230	170	340	320	180	270	450	203
	55K	480	700	250	210	260	210	430	370	360			
400V	H7.5K	220	300	190	160	150	100	240	220	160	190	320	165
	H15K	250	400	190	190	195	130	260	260	170			
	H30K	340	550	195	220	215	140	340	310	180			
	H55K	480	700	250	280	255	190	400	380	285	270	450	203



FR-HC High-power Factor Converters
FR-RC Power Regenerating Converters

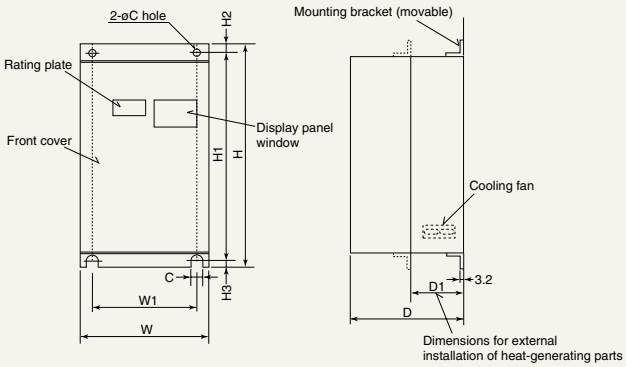
External Dimensions



Notes:
1. Be sure to open inverter power input terminals R, S and T. If they are incorrectly connected, the inverter will be damaged. Also, if the polarity of terminals P and N are mistaken, the high-power factor converter and the inverter will be damaged.
2. The wiring of terminals R4, S4, T4 and terminals R, S and T must match the power supply phase shift.
3. Be sure to confirm the order in which reactor 1 and reactor 2 are connected. The reactors will overheat if connection mistakes are madde.

FR-RC Power Regenerating Converters

- Capable of regenerating braking energy generated by motor into power.
- Designed so that heat generated by the converter can be isolated outside of the panel by installing heat generating parts externally at the rear of the panel.



Model name FR-RC-□□K	15K	30K	55K	H15K	H30K	H55K
Input voltage	3-phase 200V 50Hz 200~230V 60Hz			3-phase 400V 50Hz 400~460V 60Hz		
Permissible input voltage fluctuation	±10%					
Applicable inverter	7.5K~55K (select internal switch according to motor capacity)					

External Dimensions

(Unit: mm)

	Model	W	H	D	D1	W1	H1	H2	H3	C	Approx. weight
200V	FR-RC-15K	270	450	195	87	200	432	10	8	10	19kg
	FR-RC-30K	340	600	195	90	270	582	10	8	10	31kg
	FR-RC-55K	480	700	250	135	410	670	15	15	12	56kg
400V	FR-RC-H15K	340	600	195	90	270	582	10	8	10	31kg
	FR-RC-H30K	340	600	195	90	270	582	10	8	10	33kg
	FR-RC-H55K	480	700	250	135	410	670	15	15	12	56kg

Selection Table

Short-time rated %ED at 150% braking torque

Motor capacity			7.5kW	11kW	15kW	18.5kW	22kW	30kW	37kW	45kW	55kW
Inverter		200V	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
		400V	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
200V	FR-RC-15K	%ED	45	45	25	—	—	—	—	—	—
	FR-RC-30K		—	—	45	30	25	25	—	—	—
	FR-RC-55K		—	—	—	—	—	45	35	25	25
400V	FR-RC-H15K	%ED	45	45	25	—	—	—	—	—	—
	FR-RC-H30K		—	—	45	45	45	25	—	—	—
	FR-RC-H55K		—	—	—	—	—	45	45	45	25

Be sure to install an FR-BAL power factor improvement reactor to balance the power supply.

Points to Note when Using and Selecting Units

For Maximum Safety

- In order to use the equipment properly and safely, please be sure to read the manual before use.
- This product was not designed or manufactured as equipment or a system to be used in situations that can affect or endanger human life.
- When considering this equipment for operations in special machinery or systems used in passenger-moving applications, medical applications, aerospace applications, atomic power applications, electric power applications, or submarine repeating applications, please contact Mitsubishi Electric Corporation's sales department.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices when it is used in facilities where a breakdown in the product is likely to cause a serious accident or loss.
- Please do not use loads other than 3-phase induction motors.

Operation

- To avoid damage to the inverter when an electromagnetic contactor (MC) is installed on the primary side, please do not subject the MC to repeated start/stop operations.
- When a fault occurs in the inverter, the protective function activates and halts inverter output, but does not suddenly stop the motor itself. For this reason, please install the mechanical stopping and holding mechanisms necessary as mechanical equipment for emergency stops.
- Even if the inverter's power supply is cut off, it takes time for the capacitor to discharge. When carrying out inspections, wait for at least 10 minutes after the power supply has been cut off, then use a tester, etc., to confirm the voltage.

Wiring

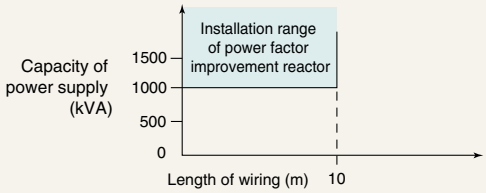
- The inverter will be damaged if electric power is applied to the inverter's output terminals (U, V, W). Before switching on the power, please check wiring and sequence very carefully to ensure there are no wiring connection errors.
- Terminals P, P1, PR, PX and N are designed for use in connecting specially designed, dedicated options. Do not connect equipment other than dedicated options to these terminals. Also, please do not create a short circuit between power terminal 10, which is used for setting frequency, and common terminal 5.

Installation

- Please install the unit in a clean location, avoiding adverse environments such as oil mist, fluff, dust, etc., or use it within a sealed enclosure which will not allow the entry of floating particles. In the latter case, please ensure that the cooling system and dimensions allow the inverter's ambient temperature to remain within the permissible values (see page 9 for specification values). The enclosure can be made more compact if the FR-A5CN option is used for isolating the inverter's heat generating parts outside the enclosure is used.
- Since certain parts of the inverter can get extremely hot, do not attach it to combustible material.
- The unit should be attached to the wall, vertically

Power Supply

- In cases where the unit is installed directly below a large-capacity power supply (1000 kVA or over, length of wiring 10 meters or less), or where switching of a phase advance capacitor occurs, an excessive peak current may flow in the power input circuit, damaging the inverter. In such cases, be sure to install an optional FR-BEL or FR-BAL power factor improvement reactor.



- If a surge voltage occurs in the power system, the surge energy may flow into the inverter, causing the inverter to execute an over-voltage alarm stop. In such cases, be sure to install an optional FR-BEL or FR-BAL power factor improvement reactor.

Settings

- Using the control panel or the parameter unit for setting makes it possible to set the inverter for high-speed operations up to 400Hz, so a mistake when setting can be very dangerous. Use the upper frequency setting function to set an upper limit. (The default setting is a maximum frequency of 60Hz during external input signal operations. PU operations are set for 120Hz.)
- Please do not set the regenerative brake duty function (Pr. 70) except when the optional brake resistor is being used. Since this function is used to protect against overheating of the brake resistor, do not set it at a level that exceeds the brake resistor's permissible duty.
- Setting the DC braking voltage and operation time at a higher value than the default setting can cause motor overheating (electronic thermal relay trip).

Points to Note

Selecting Inverter Capacity

- In the cases where special motors or several motors are operated in parallel using a single inverter, select an inverter whose capacity is such that the total rated current of the motors is equal to or less than the inverter's rated output current.

Motor Starting Torque

- The starting and accelerating characteristics of motors driven by inverters are constrained by the overload current rating of the inverters used in combination. Torque characteristic values are smaller than when general commercial power supplies are used. When a large driving torque is necessary and even advanced flux vector control is inadequate, please choose an inverter with a capacity that is one rank higher, or increase the capacity of both the motor and the inverter.

Acceleration/Deceleration Time

- The motor's acceleration/deceleration time is determined by the torque and load torque generated by the motor, and by the moment of inertia (GD^2) of the load.
- In the case where the current limit function or stall prevention function activates during acceleration/deceleration, the time sometimes increases, so please make the acceleration/deceleration time greater.
- When you wish to shorten the acceleration/deceleration time, make the torque boost value larger or select advanced flux vector control. (Making the torque boost value too large may activate the stall prevention function, otherwise, try lengthening the acceleration time.) If this is still not enough, increase the capacity of both the inverter and the motor. To shorten the deceleration time, it is necessary to add the optional FR-ABR brake resistor for frequent braking operations (for capacities of 7.5K and below), or the optional FR-BU brake unit or the optional FR-RC power regenerating converter, etc., necessary for absorbing braking energy

Points to Note when Selecting Peripherals

Selecting and Installing No-fuse Breakers

Please install a no-fuse breaker (NFB) on the incoming side to protect the wiring on the inverter's primary side. The selection of the NFB depends on the power factor on the inverter's power supply side (changes in supply voltage, output frequency, load); In particular, since the operating characteristics of fully electromagnetic type NFBs change according to high frequency current, it is necessary to select larger capacities. (Use the materials on the appropriate breakers for confirmation.) Also, for leakage breakers, please use models that have been designed to cope with high frequencies and surges, such as Mitsubishi's New Super NV.

Handling Primary Side Electromagnetic Contactors

Inverters may be used without electromagnetic contactors (MC) on the power supply side. In the case of operations using external terminals (using terminals STF or STR), even if a primary-side MC is installed to prevent accidents caused by natural restarts when power is restored following instantaneous power failures, etc., or to ensure safety during maintenance operations, please do not use the MC to execute frequent start/stop operations (the switching life of an inverter input circuit is approximately 100,000 operations). In PU operation mode, inverters do not restart automatically after power is restored, so they cannot be restarted by the MC. It is possible to halt operations using a primary side MC, but the inverter's special regenerative brake does not function and the motor coasts to a stop.

Handling Secondary Side Electromagnetic Contactors

Please note carefully that when an electromagnetic contactor is installed between the inverter and the motor, and an OFF/ON procedure is performed during operations, a large inrush current occurs and may affect the motor. When an MC is installed for switching to commercial power supplies, etc., we recommend that you use commercial power supply switchover functions Pr. 135 ~ Pr. 139.

Installing Thermal Relays

The inverter is provided with a protection function that employs an electronic thermal relay to protect the motor from overheating. However, in cases where several motors or multi-polar motors are operated using a single inverter, please install a heat-activated type thermal relay (OCR) between the inverter and the motor(s). In such cases, set the inverter's electronic thermal relay to 0 A, and the OCR setting to 1.1 times the current value on the motor's rating plate taking inter-wire leakage current into account.

Secondary-side Measuring Instruments

When the wiring between the inverter and the motor is long, the effects of inter-wire leakage current, especially with small-capacity, 400V class units, may cause heating in instruments or Current Transformers. For this reason, please select instruments that have an adequate current rating.
When the inverter's output voltage and output current are measured and displayed, we recommend that you make use of the inverter's AM-5 terminal output function.

Removal of Power Factor Improvement Condenser (Phase Advance Capacitor)

There is a danger that the high frequency components of the inverter's output will cause overheating and damage any power factor improvement capacitor and surge killer installed on the inverter's output side. Furthermore, neither capacitor nor surge killers should be inserted because current flows in the inverter causing the overcurrent protection function to activate. Use the power factor improvement DC reactor (page 31) for power improvement.

Noise

During quiet operation, electromagnetic noise tends to increase, so countermeasures should be taken. Depending on how the inverter is installed, noise may have effects even when the carrier frequency is lowered.

Countermeasures

- The noise level can be reduced by lowering the carrier frequency.
- An FR-BIF(H) radio noise filter is effective at countering AM radio noise.
- An FR-BSF01 or FR-BLF line noise filter is effective at preventing sensor malfunctions.
- Separate wires by at least 30cm (at the very least 10cm) from inductive noise from inverter power wires and use twisted pair shielded cable for signal lines.

Leakage Current

Electrostatic capacitance occurs between inverter I/O wiring and other wiring, the ground and motor wiring. Current can leak through any of these. Its value can be affected by the carrier frequency etc., so in low noise operation leakage current increases and leakage breakers and relays can operate at unwanted times. Adopt the following counter measure to prevent this.
Countermeasure

- Lower inverter carrier frequency Pr.72. Motor noise, however, will increase.–Therefore, it is recommend that you use Soft-PWM control Pr. 240.

Power Supply Harmonics

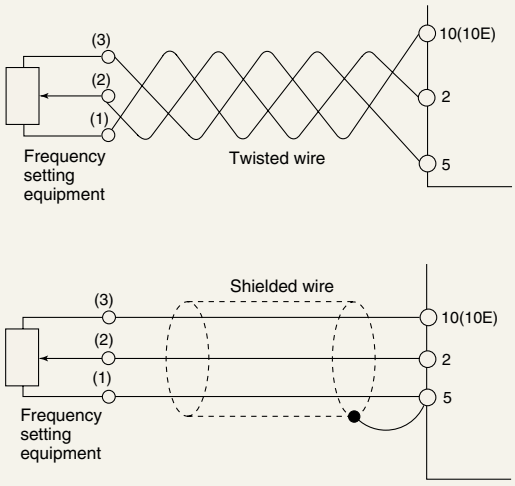
A harmonic is defined as having a frequency that is an integer multiple of its basic frequency. Normally, frequencies up to 40 or 50 times (to several kHz) are defined as harmonics, while higher harmonics are treated as noise. The table below clarifies causes and responses to noise and harmonics.

Item	Noise	Harmonics
Frequency band	Harmonic (10 kHz on up)	40 to 50 times (to several kHz)
Main cause	Inverter area	Converter area
Transmission route	Cable runs, space, induction	Cable runs
Effect	Distance, wiring route	Line impedance
Amount produced	Voltage change rate Switching frequency	Current capacitance
Phenomenon	Misdetection of sensors, radio noise, etc.	Heat produced by condensive capacitors and generators
Remedy	Change wiring route install noise filter	Install reactor

Points to Note when Selecting Peripherals

Wiring Thickness and Distances

When the wiring distance between the inverter and the motor is long, use a thick wire that will keep the drop in voltage in the main circuit cable to 2% or less, especially during low frequency output.
In cases of long distance cabling, the effects of charging current arising from floating capacity in the wiring may cause the overcurrent protection function to activate erroneously, so the maximum length of the wiring should not exceed 500 meters.
When advanced flux vector control is selected for operations, the wiring between the inverter and the motor should be a maximum of 30 meters long. (When the length of the wiring exceeds 30 meters, perform off-line auto-tuning.)
Please use the recommended connecting cable when installing the control panel (parameter unit) separately from the main body.
When performing remote operations using analog signals, the control wire between the control signal and the inverter should be a maximum of 30 meters long, and should be isolated from power circuits (main circuit and relay sequence circuits) so as not to be affected by induction from other equipment.
When the frequency is set using an external volume control (potentiometer) rather than the control panel (parameter unit), please use shielded or twisted wire as shown in the drawing, and connect the shield to terminal 5, not to earth.



Grounding

Always ground the inverter and the motor. Furthermore, when grounding the inverter, it is essential to use the inverter's grounding terminal, not its case or chassis.

⚠ Safety Warning

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

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